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1913

STATE OF NEW YORK

SECOND ANNUAL REPORT

OF THE

CONSERVATION COMMISSION

1912

DIVISION OF INLAND WATERS

TRANSMITTED TO THE LEGISLATURE JANUARY 15, 1913

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SECOND ANNUAL REPORT

OF THE

CONSERVATION COMMISSION

ALBANY, N. Y., *Jan.* 15, 1913.

HON. MARTIN H. GLYNN, *Lieutenant-Governor and President of the Senate:*

Herewith in pursuance to law we transmit to you the annual report of the Conservation Commission for the fiscal year ending September 30, 1912.

Respectfully yours,
CONSERVATION COMMISSION,
By GEORGE E. VAN KENNEN,
Chairman.

STATE OF NEW YORK

CONSERVATION COMMISSION

GEORGE E. VAN KENNEN, Ogdensburg......	*Commissioners*
JAMES W. FLEMING, Troy................	
JOHN D. MOORE, New York..............	

CHARLES H. JACKSON, Albany.......	*Deputy Commissioners*
THOMAS H. GUY, Troy.............	
JAMES J. FOX, Brooklyn............	

ALBERT E. HOYT, Albany............*Secretary to Commission*
JOHN J. FARRELL, Troy..................*Assistant Secretary*
EUGENE LAMB RICHARDS, JR., New York, *Counsel to Commission*
GEORGE P. DECKER, Rochester..............*Assistant Counsel*
RICHARD W. SHERMAN, Utica................*Chief Engineer*
M. H. HOOVER, Lockport.................*Chief of Publication*

SECOND ANNUAL REPORT

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CONSERVATION COMMISSION

1912

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OUTLINE OF TOPICS DISCUSSED.

APPENDICES.

SECOND ANNUAL REPORT

OF THE

CONSERVATION COMMISSION

To the Legislature:

We take pleasure in submitting this annual report, which while numerically our second, is the first report covering a full year's activities of the Conservation Commission, under the Conservation Law.

The intent of its framers, that there should be consolidated into the Conservation Law all laws relating to lands and forests, and fish and game, has now been complied with. The new codification covering these features of the commission's work has been in operation for some months, and has proved, in the main, satisfactory. There yet remains to be enacted conservation legislation covering the all important problem of development and utilization of the State's water resources. No question of graver moment will come before this or any other Legislature of our time.

CONSERVATION OF WATER FOR POWER PURPOSES.

Those familiar with the movement in New York for the conservation of water for power purposes must recognize the fiscal year ending September 30, 1912, as an epoch making period. The attitude assumed by the Governor, the hearings and report of the Joint Committee of the Legislature on the conservation of water, the hearings before the Judiciary Committee of the Senate on the various bills presented, the debates in the Legislature, the formulation by the Commission of its policy of State development and distribution of power and its announcement and explanation before various official and civic bodies, the unanimous endorsement of the Commission's policy at the Utica meeting of the Mayors of New York and by the State Federation of Labor, have all concentrated attention upon the subject and served to educate the

public as to the facts and issues involved. As to the principal ends that should be achieved there is practical unanimity of opinion among those having in view the best interests of the State. As to the methods to be pursued to reach those ends, there is a wide diversity of opinion. As to the foundation facts, they are well covered in a general way by the following excerpt from the Report of the Joint Committee of the Legislature on the Conservation of Water (p. 9):

> "The transmutation of water power into electrical power widens at a single stroke the area of its possible utilization. As a result of this possible transmutation the beneficial effects of falling water are confined no longer to the ribbons of territory running alongside the streams.
>
> "Developments in the transmutation of electrical current have vastly enlarged the theatre of its power. No longer is the riparian owner the only possible user of the energy of the stream. Within a radius of a hundred miles of the channeled tide any manufacturer, any municipality, any person or corporation whose business depends upon the use of power, may be a beneficiary of its translated energy. The force of Niagara Falls is being transmitted to and being utilized in Syracuse, one hundred and fifty miles away.
>
> THE CONCERN OF THE STATE.
>
> "This sudden and vast diffusion of power changes at once the light in which it must be considered. It has ceased to be local as to situation or private as to persons using it. It becomes state wide and public in its nature, rising in importance from a mere commercial to a pressing and important governmental question. Hydro-electric energy is the factor that has effected this change, that has made the development of water power a state wide issue. It affects now not merely a fraction of our population but our whole population. At the same time that these political considerations project it into the sphere of State control, the physical proportions of the problem assume dimensions of such magnitude and nature that nothing less than the State can adequately deal with it. Individually developed power has reached its limitations. The natural laws of commerce bar further progress under impulses purely commercial. Riparian owners along the various streams have invested millions in the development of water power, but this development has now reached the point of maximum commercial practicability. Beyond this point the commercial impulse will not drive.

"In another aspect also the limit of development by commercial interests has been accomplished. Human skill has contrived no shackle which will control the giant in the fullness of his strength. There is no commercially practicable mechanism that will adjust itself to the fluctuations of the driving force of spring floods at the point of application. Much must be wasted and much expended in the wild rush that fills the valleys with ruin, and does incalculable damage to the villages and towns. Then comes the summer drought and the wheels are motionless for lack of that power so lamentably wasted, so injuriously expended a few months before. It is not at the point of transmutation into useful energy, but at its head waters that the stream can be controlled, and private owners of riparian rights cannot reach the source of the streams they use. Conditions of a commercial, a physical and political nature tie their hands. Individuals as such could not agree as to the details of the necessary improvements, nor could they agree as to the proportion of expense to be borne, and beyond that they lack the sovereign right of eminent domain necessary to accomplish the object in view.

"Your committee believes, therefore, that all citizens will agree that the time has come when the State as such should undertake these vast improvements, that the sovereign power may be exercised for the common good in the execution of a task beyond the strength of any power less than sovereign."

Up to this point there is unanimity of opinion; beyond it there is divergence in several different directions.

There is at the present time in the State of New York approximately 1,500,000 unutilized horse-power, going to waste every year; and of this vast amount of unproductive energy, approximately 400,000 horse-power is absolutely owned by the State, of which nearly 100,000 horse-power is created by the construction of the canal system of the State.

THE COMMISSION'S POLICY.

The policy formulated and advocated by the Conservation Commission for the conservation of the water powers of the State, while recognizing that the previous State policy of the storage of the flood waters of the stream for the benefit of the lower riparian owners, for which benefits they should pay a revenue to the State,

is a just policy, regards that former policy as only a comparatively minor feature of a much broader one. Under the present policy brought forward by the Commission, the unused waters of the State are to be developed both by storage of flood waters and construction of plants at new sites, and the resulting energy transmitted throughout the State. Physically, the project contemplates the ultimate construction of a grand system of electric transmission covering the State by main trunk lines, with branches radiating to all points, from sub-stations located at convenient places on the main trunk system. Power is to be supplied to this system primarily by the utilization of the undeveloped water powers of the State.

The various municipalities of the State are to be furnished this power under contract with the State at a price sufficient to cover costs of production and transmission, including interest and sinking fund charges on the bonds of the State issued for the construction costs. The power is to be used by the municipalities for all municipal purposes, such as lighting their streets and public buildings, pumping city water supplies, and for supplying light, heat and power at cost to all the inhabitants. With this brief description of the proposed plan, we pass to a consideration of the reasons why it is advocated by the Commission.

LEGAL ADVANTAGES.

As has been repeatedly pointed out heretofore all procedure or proposed procedure for storing the flood waters of our streams has had to rest upon a palpable subterfuge, viz., that the proposed reservoirs are being constructed for the benefit of public health and safety, whereas the main purpose is increasing the power at sites below. In all the large projects it will be necessary to exercise the power of eminent domain, and the subterfuge was necessary in order to escape the implied provision of our fundamental law prohibiting the taking of private property for a private purpose.

Various other expedients for practical evasion of this constitutional inhibition have been proposed. The Commission holds that the only way to make the purpose a public purpose is to make the benefits accessible to the entire public. The development of power by the State at the storage dams or at points on the stream below,

and the use of that power in lighting the public streets, highways, and buildings, and for other municipal purposes, and for light and power for all, is a project having the public purpose clearly and unequivocally involved, and could sustain, successfully, the power of eminent domain.

It is believed that the Commission's plan follows the only way that is now open through the many legal difficulties. Other methods require amendments to the State Constitution that are themselves of doubtful constitutionality when referred to the federal constitution.

ECONOMIC ADVANTAGES OF THE COMMISSION'S PLAN.

In the opinion of the Commission there are two prime objects to be secured in handling the water powers of the State, and only two that are of sufficient dignity and worth to merit action by the State. The first is to advance the economic welfare of our people as a whole, and the second is to insure that the new opportunities created and benefits conferred shall be and remain open to every citizen. These objects will be attained by placing at the disposal of all our citizens power in quantities limited only by their requirements and at the lowest price consistent with self-supporting operation. The plan of the Commission is virtually to bring into use with the least possible loss of time the now wasting but wonderfully abundant water powers of the State by bringing them to market; to the doors of our farmers, merchants and manufacturers, and alongside the cheap transportation and labor markets, thus offering a premium to commercial expansion by enabling our people to produce more cheaply and live more cheaply and comfortably. The Commission believes that this plan will effect industrial expansion without industrial revolution.

It is expected that in carrying out the plans of the Commission no storage reservoirs will be built until a sufficient number of the lower riparian owners have joined in an agreement with the State, under the terms of which the State will be assured a revenue commensurate with the benefits conferred. Any legislation should give the Commission means of dealing with any owners inclined to be unfair. If deemed sufficiently important, the power from the stored water can be utilized by the State, the owners' rights therein

and a site for development being made subject to acquirement by eminent domain. It is not the intention, however, to disturb any private enterprise that is in good faith utilizing the power owned by it, but it is intended to prevent the holding of powers for speculative purposes and to prevent high prices for power being brought about and maintained by an artificial restriction of supply. The enormous quantity of undeveloped power now owned by the State will make it unnecessary to acquire more by condemnation or purchase for many years to come.

Local Sources of Power in the Capital District.

PLACE.	Head.	Economic Capacity of Hydraulic Development, H. P.		Capacity of auxiliary H. P.	Economic Peak Load Capacity, H. P.		Cost Per H. P. Per Year Delivered.		Existing Developments.	Distance from Albany.	Distance from Troy.	Distance from Schenectady.	Stream.
		Without auxiliary.	With auxiliary.		Without auxiliary.	With auxiliary.	Without auxiliary.	With auxiliary.					
	Feet.									*Miles.*	*Miles.*	*Miles.*	
Vischer's Ferry	*30	6,000	12,000	8,000	6,000	17,500	$6 88	$6 72	....	12.00	13.50	5.00	Mohawk River
Crescent	30	6,000	12,000	8,000	6,000	17,500	6 88	6 72	....	11.60	6.25	13.25	Mohawk River
Waterford	14	3,800	7,600	7,000	3,800	12,600	7 30	9 22	....	13.00	6.50	16.00	Hudson River
Troy	13	6,000	12,000	10,000	6,000	20,000	....	....	2,450	6.50	0.00	19.50	Hudson River
Total	......	21,800	43,600	33,000	21,800	67,600	....	....	....	....	....	....	....

With 3 feet flashboards.

FINANCING THE COMMISSION'S PLAN.

While, as previously stated, the plan of the Commission contemplates the *ultimate* construction of a complete system of power plants and hydro-electric primary and secondary transmission lines covering the State, the Commission considers the completed scheme as an end that will be reached by growth from small beginnings, a supply being furnished only when called for by a sufficient number of the municipalities of any group, but each step will be so taken as to fit into the final system. The system is so planned that construction by stages will entail an ultimate capital investment but little, if any, greater than would be required by construction of the entire system at once.

From the foregoing it will be clear that while the ultimate investment will be large only a very small investment will be necessary to initiate the plan, test its various features and remedy any defects that practical operation may disclose. Bearing in mind that the entire expense will ultimately be reimbursed to the State, it will be appreciated that the feature of construction by stages is one of great advantage.

POWER DEVELOPMENT FOR THE CAPITAL DISTRICT.

For example, there is an exceptional opportunity for the production of cheap power in the vicinity of the populous district comprising the cities of Albany, Troy, Schenectady, Cohoes, Watervliet and Rensselaer and the smaller adjacent municipalities, popularly known as the Capital District. The engineering corps of the Commission has prepared preliminary plans in detail for generating and transmitting power in this district. The accompanying map, Plate V, shows the area to be served, and the table the available local undeveloped powers.

It appears that:

1. The construction of the Barge canal will create near the center of the Capital District four large powers from which energy can be delivered to sub-stations in Albany, Schenectady, Troy, Cohoes and the other municipalities of the district at a price astonishingly cheap. The heavy capital costs of dams and controlling works have already been incurred by the State in the

construction of the Barge canal. Thus the project is free from the heaviest of the charges for hydraulic development, and the price for a peak load of 35,000 H. P. will not exceed $10 per H. P. per year.

2. The amount of power is ample to supply the growth of demand in the district for a long time to come.

3. As the first stage of the development, 6,000 H. P. of hydraulic machinery may be installed at Crescent, and a similar equipment at Vischer's Ferry, with transmission lines which will deliver to the cities of the district an aggregate peak load of 10,600 H. P. for a total capital investment of about $625,000.

Investigation shows that this plan will not require any issue of State bonds.

The Commission recommends that a law be passed authorizing the construction of the Capital District Project and prescribing the conditions for construction, operation and sale, and making an appropriation therefor.

INVESTIGATION OF HYDRO-ELECTRIC POWER-DISTRIBUTION IN THE PROVINCE OF ONTARIO.

A concrete example of the practicability of the policy advocated by this Commission is shown by the work of the Hydro-Electric Power Commission of the Province of Ontario. The demonstration is of the greater value because of the fact that it has been carried out under conditions almost identical with our own.

The Conservation Commission has, therefore, observed the work of the Ontario Hydro-Electric Power Commission with more than passing interest, and the Commission and its officers have visited the Province of Ontario on various occasions and have gathered a great amount of valuable data.

ORIGIN OF THE MOVEMENT FOR GOVERNMENTAL ACTION.

Canada has many fine water powers, some of the largest being comparatively close to the centers of population, yet the Canadians found that water power cost the ultimate consumer nearly as much as coal produced power. The basis of the charge was not cost of service but "what the traffic would bear." In spite of the natural wealth of the province in water powers, the rates for electric

service were the same as those in places not possessing such natural advantages, and they were in some cases even higher. This condition not only existed, but through the rapid absorption of the water power sites and the elimination of competition by consolidation and contractual relations between the different companies, it was rapidly becoming a condition that could not be ameliorated in the future without such an expense as would burden the enterprise with an interest charge that would leave any benefit to the people very much in doubt. Owing to the distance of Ontario from all the known Canadian coal fields it was clear that the prosperity of the province as a manufacturing center was inextricably bound up with the proper utilization and distribution of the "white coal" of the province. It needed but the recognition of these fundamental facts and their dissemination among the business men of the province to bring about an agitation culminating in the Ontario Hydro-Electric Power Commission and its work. A full history of the movement will be given in the complete report of the Conservation Commission. We desire to call attention in this place to a few deductions to be made from a general consideration of that history, as follows:

The movement was a popular movement, originating in common councils, boards of trade, and other civic bodies.

The movement was denounced as "socialistic," and all of the epithets and fallacious arguments that are now becoming familiar to us in connection with the Conservation Commission's policy were used in fighting the movement in Ontario.

The movement has been regarded not as a political but as a great economic question.

The government took action only upon a strong manifestation of the popular will.

The first definite recognition of the economic necessity for providence-wide distribution of power seems to have become public in 1903. In 1906 the present commission was created. In 1910 Hydro-Electric power was available from the transmission lines of the Province.

The popularity of the work and the confidence of the people in the Hydro-Electric Power Commission have been shown by ever increasing majorities in support of the policies of the Commission

whenever questions involving those policies have been submitted to the people.

As is always the case, time was required to arouse and educate the citizens. The economic merits of the project were so evident, however, that a simple understanding of it carried conviction of the necessity for applying it to Ontario.

In the words of the Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission: "The primary object that the promoters of the Hydro-Electric scheme had in mind was the maintenance of the industrial supremacy of the province." The attention of the legislators of New York is invited to this statement, and they are requested to view the policy of the Commission from the standpoint of maintaining the pre-eminence of the Empire State.

WHAT THE CONSERVATION COMMISSION FOUND IN ONTARIO.

The investigation of the Commission disclosed that from the engineering standpoint the work of the Ontario Hydro-Electric Power Commission is highly successful. The construction is of a most substantial and permanent character, and gives more reliable service than that of the public service corporations with which it competes.

The system is now entirely self-supporting, as the rates charged for power are sufficient to provide an income which will pay the interest on the bonds issued to build the system, the operating and maintenance expense, the renewal or obsolescence charge sufficient to replace the entire plant in the event of new discoveries in the electrical art rendering the present plant obsolete, and further, for a sinking fund to begin in 1914 to retire the bond issue in 30 years. These rates have been reduced to the municipalities at various times as the sale of power increases.

In the city of Ottawa, where the municipal system has been in operation for seven years, the price for private lighting has been reduced to an average of 5.4 cents per kilowatt hour, and the price for mercantile continuous power ranges from $9.90 to $22.50 per horse power. As a result of this low rate, 98% of the houses of Ottawa are lighted by electricity and the plant earns a surplus annually.

On the same basis for lighting, and with approximately 50 per cent reduction on charges for power, the municipal distribution system of Toronto has earned a surplus in the quarter ending November 30, 1912.

The sales of current have so constantly and steadily increased that the prices to the municipalities have been continually reduced.

The municipalities and private consumers are getting light and power for half what they paid private corporations.

As has already been said, previous to the distribution of current by the Hydro-Electric Power Commission, the private companies had based their rates upon the principle of charging "what the traffic would bear." The basis of the rates made by the Hydro-Electric Power Commission is "cost of service," and the rates thus made were necessarily adopted by private companies. This fact has led to a minute and thorough study by all the companies, of all the elements of cost entering into the production, distribution and sale of electric current. Such analysis is bound to result in very substantial changes and economies in the cost of operation, and also in the elimination of discriminatory sales.

A second elemental cause contributing to this result is the very great increase in the market for electric current. It has been found that the entrance of governmental competition caused no loss to those companies which were under proper management. On the contrary, their growth continued at the normal rate, or better.

The third contributing cause has been the injection of competition, which has proved to be a spur to the private company. It has too often been found that the size of the dividend has primarily determined the rate which the consuming public has been willing to tolerate. So long as the desired dividend can be earned the rate is not diminished, and economies of operation and management are a matter of little concern to the private company. Competition has created a new condition, with the result that it has been found entirely feasible to earn the customary dividend at a lower price per unit of energy.

The economic welfare of a people depends upon the intelligence with which it utilizes its natural and human resources. Labor, and natural resources in use, are the elemental constituents of production of all kinds. It is one of the most beneficent functions of

government to provide, on equal terms to all, opportunities for the development and utilization of the resources of the country. "Scientific management" is now the fashion in manufacturing establishments. Why not apply some of its principles to the large affairs of the State and Nation? Scientific management involves study and analysis of costs and conditions followed by the elimination of waste of materials and labor. Scientific study and analysis have shown that the State of New York has undeveloped water powers amounting to over 1,500,000 H. P. that are now wasting their energy. The Hydro-Electric distribution system of the Province of Ontario demonstrates the feasibility of statewide distribution of power, through the agency of government and the gratifying results achieved thereby.

CANAL POWERS.

Under the Conservation Law, section 400, the Commission is charged with the appraisal and lease of surplus canal waters whenever the Superintendent of Public Works shall certify to the Commission that such surplus waters are available. Section 21 of the Conservation Law also requires, among other things, that the Commission shall investigate the use of the waters of the State for power. Obeying these mandates, the production of power from canal waters is being investigated by the Commission.

The Barge Canal Act expressly limited the design so that the canal was solely and primarily an instrument of transportation. It was foreseen that opportunities for power development would present themselves, but under the terms of the act these could not be made available. The surplus waters of the canal can be made valuable water-powers. On the customary basis of capitalization their value will be almost one-tenth of the cost of the canal itself. Important and intrinsically valuable as they are it must be kept in mind that their development and operation is a secondary matter, entirely subordinate to the use of the canal as a medium of commerce. The experiences of the past have justified the requirement that the generation of power must not handicap nor hamper the handling of the traffic, which the canal was created to carry.

The Commission has endeavored to estimate, as accurately as

may be done in advance of the completion of the canal, the quantities of power which can be derived from the surplus water under the ordinary traffic conditions, to ascertain how much of this power will be the property of the State and how it can be most advantageously developed. This work, which is still in progress, includes the project for the Capital District, to which reference has heretofore been made.

There are various localities in which there is a question as to the legal ownership and use of the water-powers created by the construction not only of the Barge canal but also of the original Erie canal. The Commission recommends that it be empowered by law to bring proceedings which will secure the State's title to all such properties, including or affecting water-powers, so that the way may be paved for the utilization of these powers as soon as the construction makes them physically available.

ANSWERS TO OBJECTIONS TO COMMISSION'S PLANS.

In the main, the Commission's plan has received the approval of the press, and the people of the State.

It is charged, however, that the plan is socialistic in that it authorizes the State to embark in business in competition with private capital. This criticism shows a failure to draw a true distinction between a public and a private purpose.

In these days nearly every municipality is required to furnish lights for its public streets and buildings, and for domestic and commercial purposes. It is a public function, as well as a public duty. In fact, the underlying principle governing this class of service is based upon the common public necessity and welfare. The courts have drawn this distinction, and held that a State or municipality may lawfully engage in any enterprise which is based upon the common good of the people.

The federal government has applied this policy in connection with the construction of reservoirs for the irrigation of waste and arid lands; also by withholding from private entry, large areas for the purpose of controlling the water powers, with a view of the ultimate development thereof for the benefit of the consumers. Likewise, forest lands have been withheld from private occupation in order to protect the water sheds of navigable streams. Coal

and oil fields have likewise been withdrawn from private grant in order to control and regulate the price thereof.

The State of New York has in many instances engaged in activities in competition with private capital. The establishment of schools for higher education, the construction of highways at public expense, the construction of the Erie canal, and its continued enlargement, the acquisition of salt mines, the purchase and operation of the Saratoga Springs, are all instances where the activities of the State have been employed in competition with private business.

Likewise the city of New York has entered into business in competition with private interests, by the construction of subways for the transportation of its people, and also by its purchase and operation of ferries, and ownership of the dockage facilities of Manhattan Island.

The city of Chicago, in connection with its drainage system, is actually engaged in the business of developing electrical energy and distributing the same to municipalities at cost.

More than 75% of our cities, and over 90% of our urban population are provided with water by municipalities. There is no distinction between the distribution and sale of water, and the distribution and sale of electric light and energy for municipal and domestic purposes.

If the conservation plan is socialistic, then all the foregoing national, State and municipal activities must likewise be socialistic.

It is also charged that the plan of the Conservation Commission is economically unsound, for the reason that the government can do nothing as cheaply and efficiently as can private enterprise. This has not been the experience in this State with respect to the distribution and sale of water by municipalities. Very little, if any, complaint has been made, where such plants exist. Rates are reasonable, and the service satisfactory, as a rule. Official misconduct, extravagance, fraud or scandal rarely obtain in these places. Much graver, and more frequent complaint exists against private corporations that furnish light and power to the inhabitants of our cities.

It is also urged that this class of service should be left to

private enterprise, otherwise private capital would suffer through competition. This argument concedes that the State can supply power more cheaply and more efficiently than private capital. Similar arguments have been made in all cases whenever municipalities have found it necessary to engage in public service, and thereby replace inefficient private management with public devices better adapted to the needs of mankind.

It is said that the evils arising from private management may be remedied by State regulation and control. We maintain that the distribution of electric energy by municipalities would be the most effectual method of regulating the cost and service by private companies.

It does not follow that private corporations would be driven out of business. By the exercise of efficiency, by the adoption of modern methods, and by the reduction of prices to the cost of service, private companies could compete with municipalities in furnishing light and power.

DIVISION OF LANDS AND FORESTS.

The Conservation Law in relation to lands and forests (chapter 444, Laws of 1912) in its main outlines closely follows the bill which was prepared by this Commission and submitted to the Legislature for enactment, pursuant to the provisions of law. In regard to the so-called "top-lopping law," the Commission in its draft narrowed the scope of the original law so that the limbs and branches of evergreen trees should be lopped in the so-called fire-towns only; and this limitation is found in the present law. The Legislature, however, struck out the clause providing a specific penalty for failure or refusal to lop the tops. This is an anomalous condition. While there may be statutory authority for the imposition of punishment for refusal or failure to comply with the top-lopping law, nevertheless the fact that the Legislature has seen fit to eliminate the specific penalty tends to create a doubt in the public mind as to the wisdom and necessity of such a law; and in order that laws shall be respected as well as enforced it is necessary that there be no doubt in the public mind of their wisdom, or at any rate of the belief of those who enacted them that they are wise.

The Commission, therefore, on its own motion instituted an investigation and held a series of hearings to which it invited especially those persons who would be likely to be interested in the operations of the top-lopping law or who might possess special information relative thereto, as well as the general public. Care was taken, through correspondence as well as through the public press, to give as wide publicity as possible to the fact that these hearings were to be held, and to have the purpose thereof thoroughly understood. The importance of these hearings seems to require the transmission of a special report to the Legislature outlining the facts brought out and the conclusions reached. In general, however, we maintain that the top-lopping policy has been vindicated in practice and has served as an efficient means of checking the spread of forest fires. We therefore recommend the re-enactment of the clause prescribing a specific penalty for violation of the top-lopping law.

FOREST TAXATION.

In chapter 444 and in two special acts amending the Tax Law the last Legislature initiated a new policy relative to the taxation of forest lands. The underlying principle of these laws is that the owner of woodlots ought to be upon a parity with the owner of agricultural lands; that is to say, he ought not to be subjected to an annual tax when it is impossible for him to reap an annual crop. Necessarily, a long term of years must elapse during the process of reforestation, before the owner can realize any profit whatever from his investment.

BOUNDARY LINES AND VALUATION SURVEY.

One of the chief problems of forest administration has to do with the uncertainty of boundary lines. This fact is strikingly shown by a consideration of the statistics relative to trespass, which show that only three of the twenty-seven cases reported as committed during 1912 amounted to over $25 in computed value of material, and that many if not most of the trespasses at the present time appear to be due to the uncertainty of boundaries or disputes as to title.

In 1909 there were 83 trespass cases reported; computed value

of material, $39,063.07; average damage per case, $470.64. In 1910 the number of trespass cases reported was 104; computed value of material, $20,054.29; average damage per case, $192.82. In 1911 there were 46 trespass cases reported; computed value of material, $1,499.20; average damage per case, $32.59. In 1912, in the 27 cases reported the computed value of material was $502.23, and the average damage per case, $18.60.

We recommend sufficient appropriations to enable the commission to make a careful survey in order that boundary lines may be definitely established for all time, and also a valuation survey, by means of which the value of the State's holdings may be accurately determined.

While the decrease noted in the number and extent of trespasses is gratifying, if the boundary lines are thoroughly established an even better showing can be made.

FOREST CAMPERS.

At the present time campers may occupy temporary forest camps on State land, but there is no provision possible for the leasing thereof. It is estimated that there are 400 miles of suitable camp sites on the shores of lakes and ponds owned by the State in the Adirondack section alone. If it were possible for the State to lease these camp sites, under suitable regulations and restrictions, it is believed that the lessees, who would have a direct interest in the preservation of the property, would efficiently aid in the work of protecting the forests from destruction by fire; whereas, under the present system there is no accurate means of learning the names and addresses of temporary campers, from whose carelessness many serious forest fires have originated. We therefore recommend that the Constitution be amended so as to permit the leasing of camp sites in the forest preserve.

UTILIZATION OF RIPE TIMBER ON STATE LAND.

A more serious and important matter, in which the fundamental law ought to be changed, relates to the utilization of ripe or mature timber within the forest preserve. It is now known that the removal of ripe timber is necessary to intelligent reforestation and growth; and that the leaving of trees to decay not only destroys

the beauty of the forest and hampers its growth, but is an actual menace to its safety. It is known that the available ripe timber on State lands has a very great monetary value.

That the intent of the framers of the Constitution, when they prohibited the removal, sale or destruction of timber within the forest preserve, can have been to prevent the removal of dead and down timber, is hard to believe; but at any rate in the nearly twenty years since the Constitution was adopted many important economic, industrial and administrative changes have occurred and especially there has been a marked advance in the general appreciation of the importance of scientific forestry. In all logic, the fundamental law should be amended so as to permit the removal of dead timber.

THE MORTGAGE LANDS.

There are in the Forest Preserve counties of the State more than 8,000 acres of land to which the State acquired title through the foreclosure of mortgages given to the United States Loan Commissioners. Unless this was wild land when the mortgage was foreclosed it did not become part of the Forest Preserve, and therefore does not come under the jurisdiction of the Conservation Commission. We respectfully submit that all such mortgage lands, lands acquired by the State in the construction of canals and not necessary to the maintenance and operation thereof, and land which is a part of any abandoned canal system — in short, any State lands not essential to the functions of any other State department — ought to be put under the jurisdiction and control of this Commission. The result would be that all such land which is adapted thereto might be reforested, and other land could be judiciously leased, so as to produce a revenue for the State.

FIGHTING FOREST FIRES.

The organization of the fire fighting force of the Conservation Department has not been materially altered as the result of the enactment of chapter 444. There are still five districts, of which the Adirondack section has four and the Catskill section one, each of which is under the immediate supervision of an official who

was formerly known as a superintendent of fires, but is now known as a District Forest Ranger. The fire-fighting force under these officials, formerly known as fire patrolmen, are now known as Forest Rangers. It is believed that the new titles better express the duties actually performed by these officials. There is also an auxiliary force, serving only in emergencies, under the old law bearing the title of Special Fire Patrolmen, but now called Fire Wardens. Under the new law the force of railroad fire inspectors was increased by the addition of two, and the State was divided into two districts, with a Chief Inspector for each district.

The present year was marked by much more rainfall than the year previous; but in certain parts of the State during the months of June and July there was a long period of dry weather. The showing in fire protection for the year has been excellent. There were 383 forest fires reported, which was one-third fewer than the number which occurred in 1911; and of this total only a small proportion could be called large fires. Only 15 burned over 100 acres before they were checked. The total area burned during the current year is but one-fifth of that burned in 1911, and the expense of fighting fires has been reduced by more than three-fifths; the total damage done by forest fire decreased approximately three-fourths, or from $43,000 to about $11,000. Of the acreage damaged by fire only 185 acres were virgin timberland; and of the total acreage under protection by the State less than 7,000 acres, or one-tenth of one per cent. suffered from fire.

RAILROAD FIRES.

More than any other one agency, railroad locomotives have been responsible for forest conflagration, but it may be noted that no railroad fire this year burned over an area exceeding 40 acres, and most of the land which was damaged in this way was denuded or brush land on the outskirts of the forest proper, so that the actual amount of damage from this source was comparatively small. Insistence upon better cleaning of rights-of-way, the use of improved protective devices on locomotives, and increased vigilance on the part of the fire-fighting force are responsible for the decreased severity of railroad fires.

MOUNTAIN OBSERVATION STATIONS.

The mountain observation stations have again demonstrated their utility in the early detection of forest fires, and the prompt extinguishment thereof. The statistics of this department show that the number of fires reported from mountain stations exceeds the actual number of fires; but this is a demonstration not of inaccuracy but of efficiency, for it arises from the fact that in a number of cases a fire has been observed and reported from more than one mountain station. This Commission has pursued the policy of adding to the number and equipment of mountain stations as appropriations have permitted. The number of new stations installed during this year was 13, as follows: Adams, Belfry and Poke-O-Moonshine, in the county of Essex; Debar and Loon Lake, in the county of Franklin; High Point, Mohonk and Slide, in Ulster; Moose River, in Lewis; Rondaxe and Stillwater, in Herkimer; Swede, in Warren, and Tomany, in Hamilton. The total number of mountain observation stations has thereby been increased from 36 to 49, and in each case it has been necessary for the commission to construct suitable telephone connection, using its own force therefor.

REFORESTATION.

In the work of reforestation there has been a steady extension, and in the sale of trees by the State to private owners there has been a corresponding increase. At the same time private owners have had large acreages examined by this department with a view to scientific forestry and the various State Institutions are actively engaged in the practice of forestry on their various lands. During the past year two new State nurseries have been established, one of five acres on the lands of the Great Meadows prison at Comstock, where the work has been done by the prisoners, and one of five and one-fourth acres near Lake Clear Junction. The State now has eight nurseries comprising about 49 acres of land and containing approximately 19,000,000 trees of various ages. During the year nearly 1,345,000 trees have been planted on State land in the forest preserve and 560,000 at State institutions. Effort has been made to locate forest plantations along the customary lines

of travel so that they may be accessible for inspection, thereby bringing the work to the attention of the public. Out of 3,334 acres of forest preserve land which has been reforested with stock from the State nurseries, 1,353 acres were set out during the present year. The new law permits this commission to supply trees to State institutions for their use free of charge, and this provision has tended to an increased demand. The State will have available for sale in 1913, 3,692,000 transplants and 1,000,000 seedlings. For the year 1912 the State had eight nurseries, with an area of 49 acres; capacity 19,468,000 trees; trees sold to private owners, 3,587,875; trees planted on State land, 1,346,500.

Under the requirements of the Conservation Law this commission has examined nearly all of the forest properties of the various State institutions and transmitted reports to the various officers in charge, making recommendations and giving advice relative to the protection and improvement of forest and shade trees on such properties. The 40 State institutions coming under such inspection have a total land area of about 35,000 acres, and the varying character of growth, use and needs of the institutions have presented numerous problems. In general the work on the woodlands connected with the State institutions comes under three heads: First, cutting for the purpose of improvement and to provide the necessary wood crop; Second, reforestation; Third, protection against fire, disease or insects.

TREE DISEASES.

The prevalence of the chestnut bark disease and similar infections of the trees led to the creation of the position of pathologist in the Forestry Bureau of this commission and the work thereunder has been conducted in co-operation with the State Department of Agriculture. Many letters have been received making inquiry concerning tree diseases and special trips have been made to various parts of the State for the purpose of getting first hand information and co-operation with various owners. The fact that the State suffers losses each year amounting to millions of dollars through the ravages of forest insects amply justifies serious consideration by the Legislature.

PURCHASE OF FOREST LANDS.

No appropriation was made last year for the purchase of lands in the Forest Preserve. An unexpended balance amounting to the sum of $69,694.34 was reappropriated, and made available for the purchase of land in the Adirondack and Catskill Parks. Owing to the fact that so small an amount was available, no effort has been made to enter into new contracts for the purchase of lands in these parks. The money so reappropriated has been held to pay for lands which were heretofore offered to and accepted by our predecessors, subject to the production of a marketable title by the owners. A very small part of the money so reappropriated has been expended for this purpose, because it has been found that the owners have not been able to furnish acceptable title.

Of the sum so reappropriated by the last Legislature there remains unexpended $62,809.78, which we deem sufficient to pay for all lands accepted by the State, for which satisfactory titles can be furnished.

It often happens that tracts of land within the Adirondack and Catskill Parks are offered at prices which are deemed reasonable by this Commission, and in order that there may be available moneys to take advantage of such offers, we recommend that an appropriation of not less than $25,000.00 be made for this purpose.

The State now owns 1,651,553 acres of land in the Forest Preserve counties, of which 1,412,636 acres are situated in the Adirondack Park and 102,245 acres in the Catskill Park. The remaining lands, aggregating 136,672 acres, are situated in the Forest Preserve counties outside the Parks proper. These lands consist of detached parcels, widely scattered, and it has been found impracticable to protect the same properly from destruction by fire and damage by trespass. These detached tracts are largely of small acreage and of little benefit to the State.

We recommend that measures be taken to enable this Commission to sell these lands and use the proceeds thereof for the purchase of other lands within the parks proper.

DIVISION OF FISH AND GAME.

Chapter 318 of the Laws of 1912, which went into effect April 15, 1912, revised and consolidated into the Conservation Law all the laws relating to fish and game. In the preparation of this chapter, the Commission consulted with organized sportsmen throughout the State, and after it was introduced into the Legislature there were several largely attended hearings held by the Legislative Committees. In its progress through the Legislature the original bill underwent many changes, some of them of considerable importance.

The net result is a codification in which the underlying principle is that of uniformity, the endeavor having been to do away, to the utmost extent possible, with confusing and at times utterly inconsistent local provisions relative to the taking and possession of fish and game. In actual operation the new law has in the main vindicated the expectation of its framers, and it has marked a decided improvement over conditions existing prior to its enactment. It is not to be expected, however, that the first draft of a uniform law covering so large a field should be perfect; and this Commission expects to submit to the present Legislature a number of amendments intended to simplify the language and to clarify certain portions of the law, preserving, however, the underlying principle of uniformity.

ADDITIONAL PROTECTION.

It was recognized, in the framing of this portion of the Conservation Law, that there are, in so large a State as New York, involving so many different climatic conditions, certain local exigencies which require special treatment as to the close season. The law, therefore, vests the Conservation Commission with power, upon due petition, and after a hearing and proper publication, to give additional protection to fish and game by an extension of the close season as to any particular species.

Under this provision of the statute, the Commission, on May 8, 1912, issued an order prohibiting the taking of black bass in the waters of Lake George except from the first day of August to the

thirtieth day of November, inclusive. This order was made effective on the 15th day of June, 1912, and ceased to be operative on the 31st day of December. But the Lake George petition, in so far as it asked additional protection for the species of fish commonly called lake trout and pickerel, was denied, for the reason that the desired relief could not be granted so as to become effective during the year 1912.

Other petitions for additional protection to fish and game, acted upon by the Conservation Commission under the provisions of section 152 of the Conservation Law, are as follows:

COUNTY	Name of petitioner	Species	Disposition
Fulton	Hubert J. Clifford	Varying hares	Granted Jan. 15–31 inc
Herkimer	Robt. F. Livingston	Pheasants	Granted Oct. 1, 1912–Oct. 1, 1914
Otsego	M. H. Nichols	do	do.
Delaware	G. C. Pomeroy	do	do.
Chenango	Fred L. Ames et al	do	do.
Oneida	W. S. French	do	do.
Montgomery	John J. Best	do	do
Lewis	C. Fred Boshart	do	do.
Madison	Louis Fuess	do	do.
Washington	Charles B. Dix	do	do.
Warren	Charles B. Dix	do	do.
Schenectady	A. T. Sitterly	do	do.
St. Lawrence	Charles H. Simonds	do	do.
Franklin	Walter C. Rice	do	do.
Fulton	S. E. Trumbull	do	do.
Jefferson	Geo. A. Lawyer	do	do.
Clinton	F. J. Riley	do	do.
Essex	W. H. Roberts	do	do.
Genesee	C. W. Gardiner	Ruffed grouse	do.
Richmond	Ed. S. Rawson	Cotton tail rabbits	Granted Oct. 1 to Nov. 14 inc. each year.
Saratoga	John M. Corey	Pheasants	Denied.
Oswego	Mannister C. Worts	do	do.

PROSECUTIONS FOR VIOLATIONS.

Statistics on file with this department show that the game protectors have prosecuted during the present fiscal year 1,695 cases, as against 1,485 in 1911, or 210 more cases than during the preceding year. Of this total, 1,607 were successful. The time will undoubtedly come when popular sentiment is so well educated that the average citizen will be himself at all times a game protector. But until that time comes, the test of efficiency must largely rest upon the number of cases of violation of the law successfully prosecuted; and upon this test the work of the past fiscal year is satisfactory.

THE NEED OF ADDITIONAL PROTECTORS.

The Legislature of 1912 granted to this department 30 additional game protectors, making the total number 125. Effort has been made to assign the additional protectors to those counties and localities where the need of more protection appeared to be most acute. But our correspondence is replete with urgent requests for more protectors in nearly every part of the State; and there can be no doubt that additional protectors are urgently required.

If the law were amended so as to permit the appointment of sufficient regular protectors, it would then be safe to dispense with the position of special protector. These special protectors, appointed usually at the request of an organized association for the protection of fish and game, or of a board of supervisors, receive no fixed compensation. While in some cases special protectors have rendered valuable service, and have afterwards become among the best of the regular protectors, many of them have rendered but little service and some of them have proved an actual detriment to the work of the regular protective force. We believe that the moiety system, under which the special protectors are paid, is subject to great abuse and may easily lead to the starting of merely technical cases, which annoy individuals without contributing in any way to the real work of efficient protection, and may tend to bring the whole law and its enforcement into disrepute. We strongly recommend that this department be permitted to employ sufficient regular protectors so that the position of special protector may safely be abolished.

ADDITIONAL GAME FARMS NEEDED.

The State's one game farm has proved a great success, but is wholly inadequate to meet the demand for pheasants and pheasants' eggs. There is need for additional game farms. During the past year, there were 4,236 applications for birds and eggs. Out of 126,361 eggs applied for, the department was able to supply but 12,681; out of the 28,261 birds applied for, but 3,409 could be supplied. The Legislature last year passed a bill providing for four additional game farms, which on account of the condition

of the State's finances, the Governor felt constrained to disapprove. We strongly recommend that provision be made at the present session of the Legislature for additional game farms.

REVENUES OF DEPARTMENT.

Reference to the financial statement of this department, which is appended to this report, will show that the revenues turned over to the State treasury by the Conservation Commission amount at the present time to about a quarter of a million dollars annually. For the fiscal year ending September 30th last the total receipts were $256,002.84. Of this sum over $152,000 was derived from hunters' licenses. The tagging of foreign game, which is a new source of revenue, yielded over $20,000; the netting license fees amounted to about $9,000. These revenues come from sportsmen and others who are quite content to contribute something to the support of the State government, but feel that they have a right to expect better protection and propagation of fish and game as a result of their contribution. The Legislature may well bear this point in mind, as well as the fact that moneys devoted to the propagation and protection of our wild life are well invested.

DEER IN ADIRONDACK REGION.

Reports from the regular game protectors show that the supply of deer in the Adirondacks is greater than at any time during the past quarter of a century. This increase is attributed in part to better enforcement of the law, and in part to the successful experiment of cutting and stacking the marsh hay on which the deer could subsist during the more severe weather.

THE BUCK LAW.

Perhaps no feature of the Conservation Law in relation to fish and game has attracted more discussion than the so-called "buck law," which restricts the taking of deer to bucks with horns not less than three inches long. While this provision is new to the statutes of the State of New York it has been successfully tried in other states; and while it has not been in operation in this State a sufficient time for a conclusive test to be made,

the department is satisfied that it is working well and producing good results.

There have been published in various parts of the State stories of large numbers of does killed and left to rot in the forest as a result of this law, which was intended of course to prohibit the killing of does. Every possible effort has been made to run down these stories and the conclusion arrived at is that to say the least the reports have been grossly exaggerated. But over and beyond the intent of the "buck law" to protect the female of the species, was the desire in the minds of its framers to protect human life. It was intended to make the hunter more careful. We believe there is every justification for retaining the "buck law" and giving it a thorough test for at least another full season.

ADMINISTRATIVE CHANGES.

The chief administrative changes, under the new law, relative to the protection of fish and game, have been the creation of the offices of Deputy Chief Game Protector and Superintendent of Inland Fisheries, the increase of the number of protective divisions from ten to twelve, and the appointment of additional Division Chief Game Protectors accordingly. The several divisions are known as the Northern Adirondack, Southern Adirondack, Eastern Adirondack, Eastern, Western, Southern and Central New York, Hudson, St. Lawrence, Allegany, Ontario, Metropolitan and Long Island divisions.

PROPAGATION OF FISH.

The number of fish distributed from the nine hatchery stations of the State for the past fiscal year was 730,434,933. This is an increase over 1911 of 28,986,539. Fish planted in 1912 had a money value estimated at $210,934.79, while the outlay for maintenance, including repairs and improvements, amounted to but $61,505.40. This estimate of monetary value is based as far as possible upon the prices of fry and fingerlings at the commercial hatcheries and upon the market value of the different species at first hand. It is considered conservative and must be regarded as a gratifying return upon the investment.

The number of species propagated and distributed by the Commission in 1912 was thirty-nine.

The Legislature of 1912 authorized the construction of two additional fish hatcheries, one to be located in St. Lawrence county and the other in Warrensburgh. For each of these hatcheries an appropriation of $20,000 was made. A contract has been entered into for the construction of the new St. Lawrence county hatchery, which is to be devoted primarily to the propagation of bass. Up to the present time no suitable location has been found for the other proposed hatchery. When these new hatcheries have been completed, and necessary betterments have been made to the hatcheries now in operation, the State will have a plant for the propagation of fish adequate to all present needs.

This State ranks first in fish culture; but a great and growing problem has to do with the pollution of streams, which unless it can be speedily checked is a serious menace to future work in this direction. Inasmuch as the waters of the marine district, being closely contiguous to the greatest city in the new world, are peculiarly subject to pollution, our principal discussion of this question will be found under the head of Bureau of Marine Fisheries. Practically all that is there said, however, applies more or less to other parts of the State, for there are few streams or waters which are entirely free from the danger of pollution.

BUREAU OF MARINE FISHERIES.

The revenue derived from the Bureau of Marine Fisheries during the fiscal year ending September 30, 1912, was $25,154.76, being the largest in its history. There has, however, been a decrease as compared with the previous year both in the number of applications for leases of shellfish lands and in the acreage actually disposed of. This cannot be ascribed to any one cause, but is probably the result of a combination of influences, among which is doubtless the unsatisfactory condition of oyster-growing in certain localities due to the so-called "polluted oyster" scare. The natural diminution of the amount of land available for shellfish culture has also been a factor in this result.

It has previously been noted that prior to 1907 lands devoted to the cultivation of shellfish had not been the subject of any

marked degree of State regulation. On the contrary, with seemingly no appreciation of the value or possibilities of this natural resource, the State had for years granted gratuitously to individuals perpetual franchises for shellfish cultivation, and by various enactments had ceded to certain of the Long Island counties thousands of acres of valuable oyster-growing properties. The resulting situation is therefore unique. Although the total acreage under cultivation is approximately 110,000, the State has jurisdiction of less than 35,000, one-half of which is held on lease, paying an annual rental, and the balance under franchise to individuals, contributing merely an annual tax of twenty-five cents per acre.

Divided Jurisdiction.

This condition of divided jurisdiction makes effective and consistent State supervision most difficult of attainment. This was well illustrated in the fruitless endeavor during the year to secure the passage of a suitable statute for the sanitary inspection and certification of shellfish grounds and their product, a law of the highest importance to public health. The present law relative to sanitary inspection is by express restriction so limited in its application that fully two-thirds of our shellfish lands are exempt from its provisions. While the statute imposes upon this bureau the duty of making these sanitary examinations and issuing the necessary certificate, no provision was made by tax or appropriation to render compliance possible. The bill recommended by the Commission provided for a sanitary inspection tax of twenty-five cents per acre for each acre certified. It was estimated that this sum would meet the actual cost of making the examination. This provision does not appear in the law as finally passed. Whether the oyster grower should bear the cost of the inspection, or provision be made for it by appropriation, may properly be within the domain of argument, but there can be no debate on the absolute right of the public to protection against the dangers of sewage-polluted and disease-producing oysters. A majority of intelligent oyster growers recognize the necessity of cultivating and marketing their products under healthy conditions. There are, however, a few to whom profits are vastly more important than any considerations of public health.

Sewage Contamination.

That oysters polluted by sewage contamination are a menace to health is no longer an open question. Many acres of shellfish lands lie in waters that are receiving the untreated sewage of some of the most populated districts of the State. A sanitary survey of Jamaica bay made under the direction of this department during the year shows that upwards of 40,000,000 gallons of raw sewage are daily discharged into its waters — subject to the action of wind and tide. These waters cover 2,600 acres of oyster bottoms, as well as an extensive area of natural clamming lands. The growth of population in the metropolitan district, particularly on Long Island, has made the question of sewage contamination one of ever-increasing seriousness. While polluted areas may be utilized within a proper limit in oyster culture, no shellfish showing contamination to a degree dangerous to health should be marketed from such districts. The report of the Metropolitan Sewer Commission for the year 1912, recently published, contains an exhaustive study of the subject of the contamination of the waters adjacent to New York, and embodies the findings of a committee of experts acting for the municipal authorities. Their work will undoubtedly find practical expression in a system of sewage treatment and disposal that will be most effective in the elimination of the nuisance. The example of the city of Baltimore in protecting its harbor and the valuable oyster bottoms adjacent thereto by means of a system of sewage-disposal plants is a splendid illustration of the results possible of accomplishment by modern methods. Undoubtedly, many sensational reports have been current concerning the oyster as a typhoid carrier, the majority of which were without foundation in fact. Nevertheless, enough has been demonstrated to make impossible of denial the assertion that the disease has been positively traced to this bivalve. The problem of sewage disposal is primarily a matter of local regulation.

Sanitary Examination.

Pollution cannot be eliminated at best until after the lapse of a considerable period, but in the meantime it is imperative that the Conservation Law be amended to provide for the sanitary

examination of every acre of shellfish lands within the State. The State's certificate of sanitary condition would quickly be recognized by oystermen as a valuable business asset, tending to inspire public confidence in the healthfulness and safety of this most delicious food, at present so commonly looked upon with suspicion, and by many refused altogether unless cooked. The cost of making the examination should be borne by the growers. The examination should be made in part by a bacteriologist, following the standard of purity for shellfish adopted by the United States Pure Food Inspection Bureau. This is absolutely essential if our growers are to protect themselves in the shipment of their products in interstate commerce. The conditions found in Jamaica bay do not by any means condemn all the oyster lands covered by its waters, but they do determine that within certain areas the degree of sewage-pollution is sufficiently great to render oysters grown in such districts unfit for food if marketed directly from these waters.

By chapter 522 of the Laws of 1912, supplementing chapter 568 of the Laws of 1909, the State granted to the city of New York all lands under water in Jamaica bay, for harbor purposes. This will result in the destruction of many acres of shellfish lands. Nevertheless, the necessity of efficient supervision is not in the least diminished.

The discharge of untreated sewage and the waste product of manufacturing establishments into the Hudson river has resulted in the destruction of many acres of oyster lands, and has wrought great damage to shad and other fisheries in those waters. The growing appreciation of the necessity for sewage-disposal plants and the agitation for them in our cities is at least a hopeful sign; their installation means the abatement of a nuisance and menace of huge proportions.

Every country of Europe prohibits its manufacturers from discharging those waste products into public streams. Our law contains such a prohibition when the waste is destructive of fish life or oyster culture. There is no practical method for its enforcement. The Commission should be given power to determine whether or not the degree of pollution is sufficient to endanger fish life and the right to an injunction if necessary to give effect to the statute.

Shellfish Leases.

Section 304 of the Conservation Law requires that all leases of lands under water for shellfish culture must be sold at public auction, and that no lands shall be leased for less than twenty-five cents per acre per annum. If the sole purpose of auctioning leases was to promote competition, this provision of the law is a failure. There never has been any competitive bidding. This bureau, however, refuses to accept bids of less than two dollars per acre per annum.

The lands are now and have been for the past five years invariably struck down on a single bid at the uniform price of two dollars per acre per annum, regardless of locality or any other condition, save only that oyster beds of natural growth are not leasable. This uniform rental seems to have been the result of custom rather than inspired by any endeavors to ascertain true rental value. That it has at times been in excess of the actual value is evidenced by the occasional surrender by the lessee of parcels, the productiveness of which evidently is not sufficient to warrant the further efforts of the holders to cultivate them. During the year the bureau has been confronted with a new situation which may require a departure from the custom of leasing at a uniform price. The amount of land in our bays and protected waters still available for lease is not large. There is believed to be no considerable area of good shellfish land still unleased outside of Staten Island sound, Raritan bay, and one or two other protected bodies of water. There is, however, a very considerable acreage in Long Island sound that might be available, but which it is contended by planters could not be profitably leased at two dollars per acre. It is the desire of some of the planters to take up these lands "for experimental purposes" at greatly reduced rent for the first five years of the lease, with the privilege of cancellation at any time. It is claimed that these lands being in open waters, usually considerable distance from harbors, exposed to storms, shifting sands, and the ravages of the oyster's natural enemies, the star-fish and borer, cannot be profitably leased at the present uniform price. A radical decrease in rent must be supported by a substantial reason. The statute makes it incumbent on the Commission to classify the leaseable lands according to their value. This subject has, during

the year, received a great deal of attention for the purpose of establishing a rational basis of valuation in lieu of the present unscientific and haphazard method. A study of the methods in vogue in other States is on the whole unprofitable. The natural conditions are dissimilar. Location, character of bottom, food contents of water, salinity, temperature and currents are all important elements in arriving at an accurate conclusion. The practical difficulty is that the determination of most of these elements is not within the power of the bureau as at present equipped. The experience of practical oystermen is doubtedless of value, but it should be supplemented by science. Reasons multiply why this bureau should have, conveniently located on Long Island, a biological laboratory where problems of this character could be studied. At such a marine station our bacteriological examinations of shellfish could be made; studies in the habits, spawning grounds and propagation of marine food fish prosecuted. With the limited means at our disposal we succeeded in propagating at the Cold Spring Station nearly 400,000,000 marine species during the present year. Could we not reasonably expect to accomplish a vast deal more toward augmenting the supply of food fish with proper facilities?

New York is not keeping pace with some of the other states in these matters, although its oyster and marine fish resources have now great potential value and might be easily developed for the public good. There are many problems relative to oyster culture that could be solved at a marine biological station. A distinguished scientist in recommending the establishment of such a laboratory to the shellfish authorities of a sister state says: "Nowhere in the world is the star-fish so destructive to the oyster as in Long Island sound * * *. Any discoveries that could abate this nuisance would be worth more to the oyster growing interests of the State than the cost of a fully equipped biological station for a century. It is not expected that any such complete success will come from the establishment of such a station any more than the agricultural interests of the State expect that the San José scale or the potato beetle will be exterminated by the State Entomologist, but it is a well demonstrated fact that the money expended on insect investigation is returned tenfold to the

people of the State and that without such investigations successful agriculture would hardly be possible." Connecticut and New Jersey have for several years conducted marine laboratories for the investigation of these important questions.

Concerted Action Required.

The best results in the propagation of marine migratory food fish require concerted action on the part of the various Atlantic Coast and Gulf States and particularly uniform legislation covering those species which it is desirable to protect by the establishment of a minimum size limit. A convention of the marine fisheries authorities will be held during the present year and probably in conjunction with the federal fish Commission.

The need of proper laws regulating the use of nets in the marine district is great. While the inland fishermen in the Hudson and those north of the city of Newburgh are subject to an annual net license, those south of that point or operating in the waters adjacent to Long Island are subject to no license fee and practically exempt from all restriction. The unwisdom of such legislation needs no comment. In no other State in the Union are pound nets holding tons of marine fish permitted to operate without making some return to the State. A just and reasonable tax upon an apparatus of this character should not meet with serious opposition. The revenues thus acquired if used in the interest of augmenting by scientific methods our food fish supply would bestow substantial benefits on those engaged in fisheries as well as greatly increase and cheapen an important source of wholesome food.

DIVISION OF INLAND WATERS.

The Commission has made during the past year an extended study of the legal and engineering features of the development of power at Niagara Falls. The amount of water which may be diverted for power purposes from the Niagara River above the falls has been fixed by treaty with Great Britain at 36,000 cubic feet per second on the Canadian side, and 20,000 cubic feet per second on the American side. Under a Federal law, the water on the American side is used under permits issued by the Secretary

of War. Permits have been issued to two existing companies to use an aggregate of not exceeding 15,100 second feet. Five hundred second feet have also been allowed for use at Lockport from the Erie canal, leaving 4,400 second feet still unassigned.

The total fall from Lake Erie to Lake Ontario is 327 feet. The fall of the river from a point opposite the intake of Niagara Falls Power Company to the Devil's Hole is about 300 feet. A flow of 20,000 second feet used on this head would give about 540,000 net horse power. This is about the ultimate amount that can be economically developed on the American side under the present treaty. Owing to incomplete utilization of fall, the present companies can ultimately develop under the most favorable conditions of operation only about 210,000 H. P., with 15,100 second feet.

With reference to the 4,400 second feet, for which permits have not yet been issued by the Secretary of War, the Commission believes that every effort should be made to retain it for the use of the State.

OSWEGATCHIE RIVER POWER SURVEYS.

The Commission has continued the work of making surveys of the streams of the State with special reference to ascertaining the amount of developed and undeveloped powers. An engineering party has worked the entire season on the watershed of the Oswegatchie river. Field work is still in progress, and the results of the survey are not yet available. It is proposed to issue a pamphlet covering the entire subject of power development on the Oswegatchie river as soon as the work is completed and the results compiled.

Several promising sites for storage reservoirs have been surveyed and the magnificent power possibilities of the Oswegatchie investigated.

ORLEANS WATER SUPPLY PROJECT.

In the counties of Erie, Niagara, Orleans, Genesee and Monroe, comprising the northwestern section of New York State, natural conditions and their modifications, brought about by settlement and cultivation, have combined to make it very difficult and costly for the numerous small cities and villages to secure adequate supplies of pure and wholesome water for domestic purposes.

Supplies from wells are utilized by several of the municipalities, but the region is not an artesian basin and all well supplies are merely local surface waters more or less naturally filtered. Their quality is almost universally bad because of both pollution and hardness. In quantity they are entirely inadequate. Their cost is excessive.

The Niagara river and the Erie canal waters are the only easily available supplies adequate in quantity. The Niagara river supplies the larger cities of the region, and the canal is drawn upon more or less frequently in case of shortage by the other municipalities. The Niagara river waters when filtered under competent supervision can be made reasonably pure and wholesome, but their use in an untreated condition or after treatment under inexpert supervision is pregnant with public peril. Against the use of canal waters there is a public prejudice such that other water can be sold at almost any price in competition with water from the canal whether treated or not. This public prejudice arises from unhygienic conditions existing along the canal, and it is entitled to respect and sympathy.

In the face of the natural and artificial difficulties set forth above, the resources of any but the very largest municipality are puny and inadequate, and as a result the municipal water supplies of the region are either entirely inadequate or impure, or both.

These conditions challenged the attention of the Conservation Commission very soon after its appointment and organization, and active studies of the problems were immediately begun under the authority of the Conservation Law.

Typhoid in the Lake Ontario and Western Division of the State.

The section of the State covered by this project corresponds roughly with one of the divisions of the State made by the Board of Health and called by them the Lake Ontario and Western Division. This division has normally a lower death rate than the average for the entire state in the ratio of 11.7 to 16.8, and lower than five of the seven other divisions of the State. As to typhoid fever, however, the showing is the reverse. The district has the undesirable record of being the third in the list of districts arranged according to the average death rate from typhoid for the ten

year period 1901–1910, and in some of the individual years it jumps into the lead.

Typhoid is a water-borne disease, and the high ratio shown is unquestionably due to the inferior quality and contamination of the water supplies used in this district. Filtration carried out under competent supervision would, of course, partly remedy the situation, but the cost of pumping, filtering and repumping where necessary is heavy, and is especially relatively great when the quantity of water is small. The larger cities are able to carry out such enterprises without seriously feeling the burden, but the small municipality finds it very difficult and expensive to secure and pay for the kind of service required to obtain proper results. It is the essence of the scheme herein proposed to secure for all of the municipalities of the region the advantages which can be obtained from operation on a large scale. For each municipality to reach out and secure individually an adequate supply of water of the kind demanded is impracticable financially. By uniting them all in one system, a supply can be secured at a price little if any greater than the cost of individual pumping and filtering alone, even if water otherwise suitable were at hand.

The Proposed Supply from Linden.

To meet the requirements of the district and furnish an adequate supply of superior quality, the Commission proposes to impound the waters of Little Tonawanda Creek in a reservoir to be created by the construction of a dam across the creek at Linden. This proposed supply was selected for investigation after considerable study and reconnaisance. Surveys, underground investigations, stream flow estimates, and plans for filtration and distribution have been prosecuted, and have proceeded to a point where the project is well blocked out and reliable preliminary estimates of cost can be made.

Brief Description of Proposed Supply.

The drainage area tributary to the reservoir is 21.7 square miles. The rock is near the surface over the entire area, and the run-off should be a large percentage of the rainfall. In the region along the lower Hudson, where the rainfall is somewhat heavier than

in this region, the run-off from each square mile, if it is all conserved, will supply 10,000 people. The yield of this drainage basin will probably be sufficient to supply from 150,000 to 200,000 people if it is all conserved, as may be very readily done by the Linden reservoir.

The dam site is just above the bridge at Linden. It is particularly favorable. The foundations will be in solid rock. The length is short, and the sides of the canyon steep. The crest of the spillway will be at an elevation of 1,151 feet above sea level, and about 80 feet above the bed of the stream at the site. About 10,000,000,000 gallons of water will be impounded and 1,150 acres of land flooded.

From the reservoir, the water will be taken to a filter plant below, and be filtered, though the supply would be perfectly sanitary without the filtration. Filtration in this case is simply an insurance measure, so far as healthfulness is concerned. Filtration will, however, improve the appearance and taste of the water.

Quality of Proposed Service.

The proposed supply will be free from deleterious bacteria, clear and fairly soft. The head available is not only ample, but will have to be reduced before introduction into the systems of the municipalities to be served. The reduction in insurance rates in towns now served with supplies insufficient in quantity or pressure will aid materially to pay for the new service.

Capital and Operating Costs of Orleans Project.

The preliminary estimate for the entire cost of the project is $5,000,000 for the reservoir dam, spillway, regulating works, filters, clear water reservoir, land damages, highway relocation and entire piping system, figured to supply to the municipally owned standpipes a total of 19,000,000 gallons daily.

Based on state or county or water district bonds, this project could be financed on about a 4% basis. The cost of operation and repairs is estimated at $25,000 per year. The total yearly charges become:

Interest 4% on $5,000,000	$200,000 00
Sinking fund charge (50 yr. 4%)	32,750 00
Operating costs	25,000 00
Total	$257,750 00

Cost per million gallons:

$$\frac{\$257,750.00}{19 \times 365} \text{ is } \$37.17$$

Availability of Linden Supply.

In considering the availability of the Linden supply in comparison with other sources, the following points must be taken into account:

The cost to the municipalities of pumping alone ranges from $25 to $75 per million gallons when all expenses are properly included.

To filter the water under proper supervision will cost the municipality from $5 to $15 per million gallons.

For many of the municipalities, sufficient acceptable potable water cannot be obtained at any price less than several times the cost of this proposed supply, and for the smaller municipalities, the price for a suitable supply on the small scale is prohibitive.

Pumping charges are a continuous cost; but the cost of the Linden water will be almost nothing at the end of fifty years when the bonds have been paid.

The character of the proposed supply is superior to all the present supplies and incomparably better than the majority.

The saving in fire losses and insurance, and in doctors' bills, loss of time in sickness, and all the other expenses due to sickness resulting from water-borne diseases, must be credited to the Linden supply in making up the comparisons with other supplies, contaminated as we have shown them to be.

WATER SUPPLY APPLICATIONS.

The work of the Commission during the past year in the equitable apportionment of water supplies to the various municipali-

ties of the State, as required by law, is briefly indicated by the following table:

No.		Application filed.	Disposition.
40	New York City, Suffolk County Sources	July 29, 1908	Pending.
100	Village of Mexico	Aug. 12, 1911	Disapproved April 13, 1912
101	New York City, Borough of Richmond	Sept. 12, 1911	Approved June 3, 1912
102	New York City	Sept. 12, 1911	Discontinued
103	Manhasset-Lakeville Water District	Oct. 24, 1911	Approved December 20, 1911
104	Village of Argyle	Dec. 9, 1911	Approved February 28, 1912
105	Staatsburg Water Co	Dec. 11, 1911	Approved January 25, 1912
106	Village of Albion	Jan. 31, 1912	Pending
107	East Williston Water District	Feb. 16, 1912	Approved April 30, 1912
108	Village of Middleport	Feb. 19, 1912	Approved April 15, 1912
109	Baldwin Water Co	March 29, 1912	Approved May 6, 1912
110	New York City-Schoharie Watershed	April 2, 1912	Pending
111	Village of Grandview	April 3, 1912	Approved May 27, 1912
112	Village of Piermont	April 19, 1912	Approved May 27, 1912
113	Hartsdale Water District	April 15, 1912	Approved June 4, 1912
114	Village of Wolcott	April 22, 1912	Approved June 4, 1912
115	Spring Valley Water Works & Supply Co	April 27, 1912	Approved May 27, 1912
116	Village of Mt. Morris	May 10, 1912	Pending
117	Village of Peekskill	May 14, 1912	Approved July 31, 1912
118	Village of Fayetteville	May 27, 1912	Approved July 31, 1912
119	Village of Port Leyden	June 7, 1912	Approved September 10, 1912
120	Rochester & Lake Ontario Water Co.	June 14, 1912	Approved July 31, 1912
121	Village of Briarcliff Manor	June 22, 1912	Incomplete.
122	Sodus Water District	July 9, 1912	Approved September 10, 1912
123	Village of LaSalle	July 9, 1912	Approved July 31, 1912
124	City of Cortland	June 22, 1912	Approved July 31, 1912
125	Village of Brockport	July 23, 1912	Pending
126	Locke Water District No. 1	July 27, 1912	Approved September 24, 1912
127	Madrid Water District	Aug. 31, 1912	Pending
128	Albion Water Works Co.	Sept. 11, 1912	Pending
129	North End Water District Town of Scarsdale	Sept. 16, 1912	Pending
130	New Castle Water Co	Sept. 23, 1912	Incomplete

The Commission should be empowered by law to intervene in the not infrequent cases in which existing water supply systems, especially those of private companies, are found inadequate to meet the demands for water of the communities which they serve. Control of rates charged for water should be exercised by State authority, as complaints of excessive and inequitable charges have been numerous.

The State should exercise greater control over the purity of the drinking water supplied to its inhabitants. Power to compel the

authorities of an existing water supply system to abandon a contaminated source of supply, to eliminate sources of pollution, or to install and maintain proper filtration or other purification works, has been granted to certain departments and commissions in other States.

All sewerage and drainage projects, which are required to be approved by any State commission or department, must also be approved by this Commission. One hundred and fourteen projects have been passed upon during the past year. The law should be amended so as to define with more exactitude the duties of the Commission in this regard.

INSPECTION OF DOCKS AND DAMS.

Supervision and inspection of all dams (excepting those forming a part of the State canal system) and all such docks as are by law placed under the supervision of the Conservation Commission, have been continued during the fiscal year.

A system of records has been devised by means of which ready reference can be made to the maps, plans and papers pertaining to each dam so far inspected.

In the course of the next two years, it is expected that the inspection records will include every dam of sufficient importance to make its possible failure a menace to life and property.

In the case of all new dams or reconstructed dams, the plans have been examined and approved, amended or rejected, as the merits of each case required.

Plans for sixty-four dams have been approved during the fiscal year. Forty-six other dams have been inspected and strengthening or improvements ordered or recommended.

Twenty-two dams have failed or gone out during the fiscal year. A few of these were large and important structures. Each of these dams, immediately following its failure, has been inspected, and the causes of failure, so far as possible, ascertained.

All of the dams which failed were constructed before the existence of the Commission and many of them were old, while a few were intended to be of modern and good design, in the construction of which the owners did not try to keep down cost, at the risk of disaster.

Had the plans of the dams, the failures of which were reported to the Commission, been inspected as is now done by competent engineers, under the Commission, it is believed that none of them would have failed.

The importance of supervision becomes more and more apparent as the dangerous condition of old dams is revealed by their failure in some cases and by the inspections in others.

HYDROGRAPHIC INVESTIGATIONS.

The Commission has amplified during the past year its investigations of the rainfall and stream flow in this State and the collection of data thereon.

In the year 1912 the stream gaging work was brought to a high degree of accuracy and efficiency by the introduction of automatic recording gages, stay wires, measurements through the ice covers of the streams and the establishment of permanent controls at a number of the gaging stations. The accuracy of the rainfall records has been increased by the installation of density buckets and snow tubes, which make it possible to obtain records of the snowfall with increased precision.

During the past year the following new stream gaging stations were established:

Hudson River at Spier Falls; Indian River at Indian Lake; Oswegatchie River at Newton Falls; Owasco Lake Outlet at Auburn; Deer River at Ironton; Little Tonawanda Creek at Linden; West Branch Oswegatchie River at Talcville.

In addition to the above, stream flow records were obtained from the following stations previously established by this Commission:

Ausable River at Ausable Forks; Bog River near Tupper Lake; Black River at Boonville; Canaseraga Creek at Dansville; Cattaraugus Creek at Versailles; Cedar River near Indian Lake; Genesee River at St. Helena; Genesee River at Jones' Bridge; Genesee River at Rochester; Hudson River at North Creek; Hudson River at Thurman; Hudson River at Mechanicville; Kushequa Creek at Sonyea; Moose River at Moose River; Moose River at Old Forge; Oswegatchie River at Ogdensburg; Orwell Creek at Altmar; Racquette River at Racquette Falls; Racquette River

at Piercefield; Racquette River at Massena Springs; Sacandaga River at Hope; Sacandaga River at Hadley; Sacandaga River at Blackbridge; Salmon River at Stillwater; Salmon River at Pulaski; Schroon River at Riverbank; St. Regis River at Brasher Center.

New rainfall stations were established in 1912 at Linden, Genesee county; Varysbury, Wyoming county; Warsaw, Wyoming county. Records were obtained from the following previously installed stations in addition to the 118 rainfall stations maintained by the U. S. Weather Bureau in this State:

Boonville, Faust, Forked Lake, Horse Shoe, Keep-a-wa, Knowelhurst, Morehouseville, North Creek, Old Forge, Potsdam, Rome, Wakely Dam, Ward's Creek, No. 4, Wanakena, Wells.

The accuracy and reliability of the hydrometric work in New York State is attested by the fact that during the past year representatives of two foreign countries were sent by the United States government authorities at Washington to Albany to inspect this work as it is being carried on in this State.

LEGAL BUREAU.

In addition to the litigations prosecuted by the Commission through the Attorney-General, a summary whereof is hereto appended, this Commission has been carrying on an important litigation to sustain its right and power, as successor to the State Water Supply Commission, to protect by river improvement proceedings the people of the State from danger to health, life, and property.

Prior to the creation of the Conservation Commission, the State Water Supply Commission had undertaken a plan for the improvement of Canaseraga creek and its tributaries between Mt. Morris and Dansville in Livingston county. Certain property owners had petitioned the Commission, under the provisions of the so-called River Improvement Act, to undertake a plan for the relief of the inhabitants of the Canaseraga valley from severe malarial conditions, destruction of crops, and the menace to the safety of the inhabitants from floods in the valley; and in accordance therewith an order had been made, establishing the improvement with assessments upon the property owners benefited thereby

for the purpose of carrying on the work. This improvement was actually being carried out and the work was proceeding for the evident betterment of conditions in the valley, when other property owners attacked the proceedings and the powers of the Commission, claiming not only that their property was not benefited, but that the whole scheme of the Commission was illegal and void.

The action of the Commission was reviewed by a writ of certiorari, and the proceedings thereunder were heard at Special Term of the Supreme Court in Livingston county, resulting in a decision against the State Water Supply Commission, setting aside the plan of improvement and its determination in establishing the so-called assessment district.

This was the condition of the litigation when the present Commission took office. An appeal was promptly taken by this Commission through its counsel to the Appellate Division of the Supreme Court, Fourth Department, with the result that a sweeping decision was rendered by the Appellate Division, reversing the decision at Special Term and sustaining the powers of the Conservation Commission to take property and levy assessments for the purpose of river improvement where health or safety demanded.

In its opinion rendered in November, 1912, the court held that the Commission had the broadest power and discretion to determine the necessity for the improvement in the interest of public health and safety, and that in the exercise of that broad discretion the Commission could carry out the improvement in such way and by such methods as would make the improvement most effective and the cost thereof most reasonable. The court not only sustained the power of the State to assess for benefits of such improvement on the lands of unwilling property owners, but held also that where the improvement would result in an increase in the value and productiveness of agricultural lands, such value and productiveness was a proper basis for assessment.

All of which is respectfully submitted.

GEORGE E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Conservation Commissioners.

ALBANY, N. Y., *January* 15, 1913.

MEMORANDUM BY COMMISSIONER FLEMING.

I have subscribed my name to the above report as a member of the Conservation Commission, but I have done so with the express understanding that I do not approve of so much of the report as recommends a plan for the operation and distribution of hydro-electric power by the State itself.

While this plan may at some future time be proven wise and for the best interests of the taxpayers and citizens of the State, I have not been furnished with evidence which convinces me that the operations of the Ontario Hydro-Electric Power Commission, referred to in our report, have been a financial success. Until a detailed balance sheet of that Commission has been obtained I shall continue to withhold my approval of any plan which, without further investigation, may commit the State of New York to the expenditure of large sums of money, necessarily involving an increase in taxes and the expense of the State government.

JAMES W. FLEMING.

ADDENDA.

REPORT OF CONSERVATION BUREAU, ATTORNEY-GENERAL'S OFFICE, RELATIVE TO LITIGATIONS.

As provided by section 9 of chapter 647 of the Laws of 1911, the Conservation Commission transmitted to the Attorney-General all orders to bring actions, suits and proceedings which the Commission was authorized to institute and maintain, and transferred to him all the unfinished work of the legal department of the Forest, Fish and Game Commission as it existed prior to the enactment of the Conservation Law.

When the Conservation Commission took over the legal work of the Forest, Fish and Game Commission, there were pending one hundred and sixty actions which had been commenced prior to the enactment of the Conservation Law, many of which had been pending for years and had been brought by counsel designated by the Commission. These were transferred to the Attorney-General who was substituted as attorney of record for the State and proceeded to close the litigations without further delay. Of this large number of litigations, the Attorney-General, since the 12th day of July, 1911, has disposed of all except twenty-six which remain pending, and except fifty-three actions in ejectment involving title to land in township 15, Totten and Crossfield's Purchase, Hamilton county, which will shortly be concluded.

In addition to the litigations transferred to this bureau above mentioned, two hundred and thirty-seven orders to prosecute for various causes were transmitted by the Conservation Commission for action by the Attorney-General's office.

The following cases are pending:

Trespass	9
Ejectment	55
Fire	3
Fish and game	11

Top-lopping	1
Pollution	2
Action to set aside judgment	1

There have been disposed of by action during the period since taking over the legal work of the Forest, Fish and Game Commission on July 12, 1911, the following cases:

Ejectment	4
Trespass	28
Fire	7
Pollution	1
Fish and game	48
Top-lopping	9
On appeal	1
Action to determine claim to title	1
Action to set aside deed	2
Injunction	2
Partition	2

Many of the orders transmitted to the Attorney-General were settled or otherwise disposed of prior to bringing action thereon.

CONSERVATION DEPARTMENT.

Statement of Expenditures for the Fiscal Year Ending September 30, 1912.

For official salaries, Commissioners and deputies, secretaries, chief engineer and counsel........	$58,053 76
For salaries of graded employees, auditor, stenographers, clerks, etc........................	9,662 34
For salaries of additional employees, assistant counsel, cashier, confidential agents, importation agents, publication bureau, inspector of docks and dams, confidential stenographers, etc......	36,628 02
For traveling expenses and disbursements of Commissioners and deputies, counsel, secretaries officials, inspectors, experts and other employees..	13,986 43
For office expenses — rent, repairs, furniture, books, blanks, printing, postage, transportation, etc.	26,944 75
For temporary services, stenographers	2,363 70
For legal services, codifying and consolidating laws, and expenses	19,979 39
	$167,618 39

Division of Fish and Game.

Game Protection.

For salaries of chief protector, assistant and division chiefs and protectors	$99,801 33
For traveling expenses and disbursements of protectors and special protectors................	59,274 38
For payment of moieties to complainants, justices, constables, attorneys, witnesses and court costs..	17,795 82
For printing game laws	7,200 00
For maintenance and hire of steamboats and launches patrolling State waters.............	2,779 27
For tags and tagging machines................	1,500 00
For printing and advertising regulations........	144 76
	$188,495 56

Hunters' License Bureau.

For salaries	$1,200 00
For expenses of county clerks, printing licenses, books, postage, etc.	5,111 20
	$6,311 20

Marine Fisheries Bureau.

For salaries of supervisor, deputy, clerks and protectors	$14,404 42
For office expenses — rent, postage, stationery and traveling expenses of officials and protectors	7,644 48
For surveying oyster lands	882 78
	$22,931 68

Propagation and Distribution of Fish and Game.

For maintenance of hatcheries and collection and distribution of fish and fry	$48,785 40
For salaries and expenses of fish culturist and foremen	13,018 09
For maintenance, expenses and salaries — game bird farm propagation	7,540 06
	$69,343 55

DIVISION OF INLAND WATERS.

For salaries of officials and employees	$13,972 50
For rent and office expenses	361 82
For appraisal and sale of surplus canal water	911 50
For developing water power	4,999 35
For hydrographic investigations	6,900 83
For surveys, investigations and river improvement	14,893 41
For investigating river structures	445 23
	$42,484 64

DIVISION OF LANDS AND FORESTS.

For salaries of officials and employees	$29,772 50
For land purchased in forest preserve and expenses connected therewith	7,384 56
For traveling expenses and disbursements of officials, foresters and employees	4,932 76
For salaries and expenses of fire patrol and laborers fighting forest fires	79,028 58
For surveying, and protecting State's title to land.	9,031 42
For repairs to docks and buildings, St. Lawrence reservation	852 31
For John Brown Homestead repairs	46 25
For expenses of tree nurseries, making growth studies and field tables, reforesting lands, publishing instructive pamphlets, etc.	32,680 93
	$163,729 31
Total expenditures	$660,914 33

CANASERAGA CREEK IMPROVEMENT FUND.

Balance in National Commercial Bank, Albany, N. Y., October 1, 1911....................		$189,997 68
Interest on deposits to October 1, 1912..........		5,094 82
		$195,092 50
Disbursements:		
Paid Dewitt C. Stephens, contractor on construction	$31,588 13	
Manhattan Co., interest on bonds....	10,000 00	
Services and expenses of engineers, attorneys and miscellaneous accounts	8,236 94	
		49,825 07
Balance in National Commercial Bank.....		$145,267 43

SUMMARY OF RECEIPTS AND DISBURSEMENTS FROM VARIOUS SOURCES EXCLUSIVE OF REGULAR ACCOUNTS WITH THE STATE COMPTROLLER FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1912.

Receipts:

From fines and penalties collected	$25,307 28
From trespass on State land	2,291 98
From setting forest fires, fines	86 06
From failure to lop trees, fines	777 50
From tax on and rental of shellfish lands	23,676 34
From sales of seedling trees	8,422 80
From rebates on fire bills paid by State	12,274 09
From sales of hunters' licenses	152,052 55
From sales of net licenses	8,813 15
From sales of breeders' licenses	230 00
From refunds from various sources	45 45
From miscellaneous receipts	1,472 69
From sale of tags for foreign game	20,442 80
From telephone rentals	110 15
	$256,002 84

Disbursements:

By costs of collecting, fines and penalties	$851 11	
Refund account, tree sale orders	87 60	
Protested check	56 23	
Cash covered into State treasury	255,007 90	
		$256,002 84

ANNUAL REPORT

OF THE

DIVISION OF INLAND WATERS FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1912.

SECOND ANNUAL REPORT

OF THE

CONSERVATION COMMISSION

DIVISION OF INLAND WATERS

To the Conservation Commission:

I herewith transmit, pursuant to law, the annual report of the Division of Inland Waters for the fiscal year ending September 30, 1912.

Hydro-Electric Plans.

During the past year much progress has been made in furthering plans for the utilizing of the undeveloped water powers of the State for the generation of electrical energy, and the transmission of same to the various municipalities.

As a proposed first step in this development, tentative plans have been made for the building of hydro-electric plants at Crescent and Vischer Ferry for the utilization of the surplus waters of the canal and the transmission of the current to the municipalities in the capital district, including Albany, Troy and Schenectady. This is but the beginning in what is finally intended to be a state-wide development of the water powers of the State.

Inspection of Dams.

Under the supervision of the inspector of docks and dams, a systematic investigation of all the dams in the State was inaugurated. Reports on a large number of dams have already been made and many of these, defective in construction or otherwise, have been repaired under his supervision.

HYDROGRAPHIC INVESTIGATIONS.

In conjunction with U. S. Geological Survey, hydrographic work has been continued and several additional gauging stations have been established.

INVESTIGATIONS OF SOURCES OF WATER SUPPLIES AND POWERS.

During the past year a power survey was made of the Oswegatchie river and tributaries. A profile of the river was run, existing power plants were located and hydraulic data obtained, and the possibilities of undeveloped power sites were investigated.

A survey has been made and the plans drawn up for the construction of a dam across the Little Tonawanda creek at Linden for the supplying of a number of municipalities with pure and wholesome water.

Much progress has also been made in the improvement of Canaseraga creek.

Respectfully yours,
JAMES J. FOX,
Deputy Commissioner.

REPORT OF THE DIVISION OF INLAND WATERS FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1912.

Divisions of Report.— The work carried on by the Division of Inland Waters is, in a general way, divided under the following heads in the Conservation Law:

I. Water Storage and Conservation for power purposes.
II. Hydraulic Development.
III. River Improvement.
IV. Drainage.
V. Water Supply and Sewerage.
VI. Inspection and Supervision of Hydraulic Structures.

Subjects I and II come naturally together and are so treated in this report.

Arrangement of Report.— In order that those interested in a general way only may get easily and quickly the gist of the report, the principal facts and deductions brought together in the annual report to the Legislature are reprinted at the first of this report. For details the reader is referred to the specific reports and appendices following.

I. CONSERVATION OF WATER FOR POWER, AND II. HYDRAULIC DEVELOPMENT.

REPORT ON CANAL POWERS.

Scope of this Report.— To properly prepare a complete report showing the amount of power at each site on Barge canal waters and ascertain the history and ownership with sufficient detail for presentation in court for adjudication, is a work of considerable magnitude. In the following reports, we partially cover the work on some portions of the canal, giving the results of our investigations as far as they have been carried.

GENERAL STATEMENT.

Relative Importance of Uses of Canal Power and for Transportation.— The Barge canal with accessories will cost the State about $120,000,000. As an incident in the expenditure of this money there will be added to the economic capacity of water powers in the State from 60,000 to 70,000 horsepower. Although this power is located close to centers of population and good transportation facilities, it is relatively unimportant when compared to the canal as a means of transportation.

Fundamental Assumptions in this Report.— The general plans of the Barge canal including the size and shape of the prism, the permissible water velocities, the sources and quantities of water supplies, and in fact all of the fundamentals were laid down in the report of the State Engineer on the Barge canal in 1901. Some of the most eminent engineers of the entire world were employed. Their recommendations have been followed with but minor changes, and the construction work has proceeded to such a point that the canal has attained definite form. Subsequent reports and computations have resulted in substantially the same conclusions as were given in the 1901 report, except in a very limited number of instances where new data has become available.

In view of the eminence of the engineers employed the subsequent verification of their work, and the embodiment of the results in construction, it would appear almost self-evident that in arriving at our figures for the water powers available upon the canal we should accept the figures of the canal authorities as final in such matters as water requirements of the canal for navigation purposes, permissible velocities in the prism, and all fundamentals of this nature, deferring changes until they can be based on operating results and not on computations.

On the other hand, several important factors will now enter to modify to quite an extent the results heretofore obtained.

First. The Barge canal engineers have been compelled, in obedience to law, to leave out all considerations of development and use of water power by the State, or consideration of increase in water power as a source of revenue to the State. They could consider the canal solely as a means of transportation, and were obliged to disregard it as a means for developing water power.

The power question was never considered, except in so far as it came up, through claims for damages presented by power owners.

Second. Public sentiment since 1901 has undergone a profound change in its consideration of the relation of water powers to the public. The liberal treatment of water powers contemplated by the 1901 estimates of water supply and use were doubtless in accordance with the views generally held up to that time, but are not in sympathy with present public opinion. To-day public sentiment demands that any valuable by-products resulting from the expenditure of the enormous sums for the Barge canal shall not be given away nor allowed to go by default, but shall be open to use by all. For example, diversion of water from the canal at Lockport, Medina and Rochester should either be used in developments by the State, thus making them accessible to all her citizens, or else they should be made to return a suitable revenue to the State for the benefit of all her citizens. Diversions have heretofore been made at these points, resulting in very valuable additions to powers in private ownership. The owners have paid the State nothing, though the diversions have frequently seriously impaired the usefulness of the canal for transportation.

Third. In considering the water supplies the requirements have been figured upon the safe side in every case by the Barge canal engineers, and for conditions of maximum use, while the water supplies have been figured for minimum flows occurring but rarely. Power may be figured for average conditions, with steam auxiliary for those times when the canal requires the maximum amounts or the supplies are at a minimum.

The foregoing new considerations will modify to some extent the methods of computation of available water and the power belonging to the State.

Our estimates will be based upon the State's claiming all of the new power created by the Barge canal construction wherever it is believed this can legally and economically be done. Another fundamental assumed in this report is that the canal is to be used for transportation and nothing will be suffered to interfere with such use.

Velocity in the Canal Prism.— The chapter on "Tractive Resistance to be Overcome in Navigating the Proposed Barge

Canal" found on page 599 *et seq.* of the 1901 report on the Barge canal shows that this resistance increases as the square of the velocity of the boat relative to the water; that for equal propulsive power the speed of east bound fully loaded boats will be three miles per hour as against 3.75 miles per hour for west bound one-third loaded boats; and that "The great increase of power and consequent cost of the higher rates of speed compared with the moderate saving of time seem to render higher speed than three miles per hour for loaded boats in the standard section of this canal economically inadmissible." From this it is clear that for the use of equal power for the east and west bound traffic the eastward current in the canal should be .75 miles per hour and that any departure from this will cause reduced speed on west bound traffic. The figured velocity as finally determined upon by the canal authorities is .71 miles per hour. It is evident from the preceding that greater velocity of waterflow will be a detriment to navigation. Other detrimental effects are: increased wash of banks, already a serious probability from wave wash alone, which will be greatly increased (varies as the cube of the velocity) by current in the channel; and increased difficulty and hazard of navigation against or with a current in a confined channel, and with the boats in tow.

The fact that river channels are constructed for a maximum flood velocity of not over four feet per second during the navigation season is no argument for the introduction of larger velocities in the standard canal section because:

1. Such velocities are not economically avoidable and must be endured.
2. Their duration is short.
3. The river channel has a section over twice that of the canal section, thus greatly decreasing the tractive power necessary for a given speed and giving more room for the handling of barges and tows.

The use and persistent abuse of the surplus water privileges along the Erie canal were a constant detriment to the legitimate use of the canals for transportation. These troubles began within a year or two from the opening of the canal in 1825 and extended throughout its entire history, (See Assembly document No. 139

of 1870.) The history of the Black Rock and Lockport leases is particularly full of instances of interference with navigation and the works of the State, and the use of large sums of public money to secure small benefits to private owners of leases. It was also charged that the proposed enlargement above the Lockport locks in the "nine million" improvement was largely for the benefit of the Lockport powers (S. E. Report, 1898, p. 209).

In handling the subject of surplus waters of the Barge canal, the state should proceed with the utmost caution and should not attempt to push the use to the limit of possible safety to navigation.

In the sale of power belonging to the State, the greatest conservation of resources natural and artificial will result by the direct use of water on wheels already installed provided those wheels are so situated and the works so constructed that they extract the full possible power of the water. It is, therefore, desirable to allow existing plants situated as prescribed to use the water rather than to construct new works, provided that the State receives full value for the power so generated. Indeed such power users can better afford to pay the full value than can owners of new works. In following out the principle, however, the interest of the entire people in the power is sufficient to make it a proper action of the State to see that the power goes directly to the final user rather than through speculative hands.

TONAWANDA TO ROCHESTER.

Water Supplies and Velocities in the Canal Prism.—The water supply for the Barge Canal between the Niagara River at Tonawanda and the Seneca River at Savannah is to be taken from the Niagara River and carried through the canal prism. The original estimates for the water required to operate this portion are given on page 622 of the 1901 report of the State Engineer on the Barge Canal. In accordance therewith the canal has been designed to carry a minimum of 1237 cubic feet per second to the foot of the locks at Lockport. This gives a velocity in the canal prism of 1.04 feet per second.

The section from Tonawanda to Lockport was necessarily designed for the minimum stages of Niagara River. Except at extraordinary low stages of the Niagara River and Tonawanda

Creek occurring very infrequently, and for very short lengths of time, much more than 1237 cubic feet per second could be put through the canal to Lockport. The Barge canal engineers, however, are very desirous that the velocity shall be kept as low as possible. In this stretch from Tonawanda to Lockport will occur the maximum velocity in the canal outside of the river sections where the prism is much larger and velocity of water much less detrimental. This section thus occupies to an extent the position of a ruling grade on a railroad, and will have a somewhat similar effect in limiting the load that may be carried by a barge with tows over the entire canal or over a division embracing the Tonawanda-Lockport section, just as a ruling grade limits the load that an engine can pull over a division. The effect of flatness of ruling grades upon the prosperity of railways is well understood and enormous sums are expended to produce even slight reductions. As we shall see later in this discussion, however, it is very probable that more water than 1237 cubic feet per second will be required to keep the long level below Lockport flowing full even without diversions into Eighteen Mile Creek or other water sources. When the traffic on the canal has fully developed it may become very desirable to increase the sectional area of the canal from Tonawanda to Lockport or Medina at some future time, or to utilize the Medina feeder in order to reduce this "ruling gradient."

The water requirements of the canal and the canal grades, embankments and spillway elevations between Lockport and Rochester have been based upon the delivery of 1237 cubic feet per second at the foot of the locks at Lockport. We are also informed that the grades have been figured for a value of "C" = 88 in the Chezy formula — $V = C \sqrt{R S}$. If that is true, the water to be delivered at places below Lockport would be in round numbers:

1000 cubic feet per second at Johnson's.
920 cubic feet per second at Medina.
900 cubic feet per second at Albion.
815 cubic feet per second at Brockville.
760 cubic feet per second at Spencerport.
610 cubic feet per second at South Greece.
575 cubic feet per second at Rochester.

Data upon which to estimate the carrying capacity of an open channel in earth of the size of the Barge canal, and carrying water at such low velocities, is very limited — too limited to figure with certainty. Under these circumstances the Barge canal engineers naturally used a coefficient that they believed to be on the safe side in order that there might be no uncertainty as to the water supply. This value of 88 for "C" is probably a safe figure. The problem of the canal engineers was to surely supply enough water. Our problem is to predict as near as we can how much will flow in the canal as constructed. In estimating the amount of water that will be delivered at points along the canal, using values of "C" determined by Kutter's formula, for "n" = .030, .025, .0225 and .020. Table I gives the amount of water that will be delivered at points along the canal below Lockport.

TABLE I.

COMPUTATION OF WATER THAT WILL BE DELIVERED TO VARIOUS POINTS ON THE LONG LEVEL, LOCKPORT TO ROCHESTER, USING DIFFERENT VALUES OF "n" IN KUTTER'S FORMULA.

Cubic Feet Per Second Delivered.

PLACE	Barge canal engineers "C" = 88	FROM KUTTER'S FORMULA			
		"n" = .030	"n" = .025	"n" = .0225	"n" = .020
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6
Lockport	1,237	1,237	....	....	....
Johnson's	1,000	1,033	1,212	1,342	1,490
Medina	920	961	1,130	1,251	1,391
Albion	900	945	1,111	1,233	1,370
Brockville*	815*	869*	1,020*	1,134*	1,260*
Spencerport	760	811	952	1,057	1,175
South Greece	610	658	775	863	966
Rochester	575	635	745	829	930

* These quantities may be carried on to Rochester. (See Text.)

While ice conditions will reduce the amounts delivered, water for operation of the canal will not be required at such times, so that the amount available for power will on the whole be somewhat increased during the winter months.

The quantities given in columns 2 and 6 of table I are the minimum and maximum amounts of water that will flow in the

Barge canal as constructed if the depth of 12 feet is to be maintained at all points. The true amounts of water that will flow past the given points will probably be somewhere between those given in columns 3 and 6 of table I. By raising the proposed surface between Lockport and Brockville, or by lowering the surface of the water at South Greece only 0.1 foot, the amounts delivered to Brockville can be delivered to South Greece and taken thence in the Erie canal to Rochester for power development as suggested later. Such a slight departure from the use as planned is considered feasible, and would be without detriment to the canal as an agent of transportation.

If the lower coefficients of roughness are realized ("n" = .025 or less) the entire 1,237 cubic feet per second will have to be passed along the canal to Rochester if full depth is maintained at all points in the canal, and no water can be diverted at Lockport, Medina, etc.

Present Diversions.—Gagings of diversions from the canal were made in 1870, (Assembly document, No. 139, 1870), 1900, 1907 and 1908. These are all that we have been able to find. Table II gives the results of these gagings of diversions.

TABLE II.

MEASUREMENTS OF DIVERSIONS FROM THE LONG LEVEL OF THE ERIE CANAL.

Place	1870	1900	1907	1908
		Cubic feet per second		
Lockport	207	193	*239	*†300
			‡260	‡322
Middleport	23	......	......	......
Medina	74	......	*201	*219
			‡108	‡60
Eagle Harbor	56	......	......	......
Albion	76	......	*68	......
			‡102	
Holley	40	......	......	......
Brockport	36	......	......	......
Adams Basin	24	......	......	......
Spencerport	6	......	......	......
Rochester	....	......	......	141
Between Rochester and Lockport	....	171	......	......
	542			

* Average gagings of creek below canal.
† Believed to have been gagings under special conditions.
‡ Average of differences between gagings of canal above and below the point of diversion.

Lockport.

Physical Conditions.— Beginning at Tonawanda, the western end of the Barge canal, and proceeding eastward, the first opportunity for power development or diversion from the canal occurs at Lockport, 18 miles from Tonawanda. Here the canal passes through a rock ridge and down a steep slope. The difference in elevation between the two canal levels of the Erie Canal is 52 to 57 feet, and of the projected Barge canal levels 48 to 49 feet. In addition to the power afforded by this fall in the canal proper, power is obtained at Lockport and below by diverting water from the canal into Eighteen Mile creek where it is used on several falls, aggregating about 175 feet, occurring between the canal and

Lake Ontario. Several measurements made at different times show that from 190 to 250 cubic feet per second of water have been diverted from the canal over a long period of years.

Barge Canal Plans at Lockport.— The Barge canal plans at Lockport provide ways and gates by which water can be supplied to existing establishments at the locks and along the creek under the same conditions as formerly, except as to the slightly decreased head at the locks.

Plate II shows the works of the Erie canal and Barge canal at Lockport.

The power due to by-passing water at the locks is claimed by the owners of mills using it, under a lease executed by the Canal Board in 1825 to Kennedy and Hatch.

No leases or other documents conferring the right to withdraw water from the canal into Eighteen Mile creek have ever been executed, and the state receives no revenue therefrom.

The Kennedy & Hatch Lease.— Before the amount of power belonging to the state at Lockport can be definitely determined, there must be had an adjudication of the water rights belonging to present owners under the Kennedy & Hatch lease.

Conditions at Lockport After Completion of Enlargement in 1862.— This canal had a minimum sectional area of 558 square feet in rock and a flow of 933 cubic feet per second (average of 8 gagings above the locks made at different times during the year 1907 and one measurement by E. Kuichling in 1900.) (S. E. Report 1907, page 593). The average of gagings below the spillway into Eighteen Mile creek taken at the same dates is 691 cubic feet per second, showing a spill into Eighteen Mile creek of 242 cubic feet per second, while the average flow in Eighteen Mile creek from measurements on the same days give 232 cubic feet per second, showing a negative flow in Eighteen Mile creek, probably due to measurement errors or pondage of water. The results of Mr. Searles' measurements in 1876 were:

Water at Lockport. .	33,755 cu. ft. per min.	=	562.6 cu. ft. per sec.
Water at Middleport	28,100 cu. ft. per min.	=	468.3 cu. ft. per sec.
Water at Holley. . . .	19,024 cu. ft. per min.	=	317.0 cu. ft. per sec.
Water at Rochester.	12,175 cu. ft. per min.	=	202.9 cu. ft. per sec.

The water required for lockages was probably between 75 and 100 cubic feet per second. Using the latter figure there has been available in the by-passes at Lockport since the enlargement of the Erie in 1893, 833 cubic feet per second, or sufficient for about 3,800 horsepower. This is somewhat in excess of the horsepower in use as shown in Table III.

The 232 cubic feet per second diverted into Eighteen Mile creek would produce on the 175 feet of head developed 3,700 horsepower, which agrees fairly well with the 3,400 horsepower in use as given in Table IV. The horsepower in use is that reported by the power owners themselves, as shown in the Fourth Annual Report of the State Water Supply Commission, pages 693 and 694.

Table III shows the size of developments and some other pertinent facts relative to plants dependent upon the by-passed water at Lockport.

TABLE III.

TABLE OF WATER POWERS DEPENDENT ON BY-PASSED WATER AT LOCKPORT.

PLANT	Employees	Ordinary working hours	Horse-power in use	Horse-power capacity of wheels	Auxiliary power	
Water works pumping	6	24	300	832	S. 300	South Side
Electricity	5	24	275	500	S. 500	
Flour and Feed	7	24	40	85	S. 75	
Flour	30	24	225	225	S. 225	
Machinery	40	10	35	46	E. 30	
Trucks and blocks	50	10	50	85	S. 85	
Tackle blocks	100	10	52	85	S. 50	
Excelsior	14	10	75	360	E. 100	
Milling machinery	50	10	30	75	S. 27	
Wood pulp	25	24	1,500	2,613		
Wood pulp	6	24	500	1,035		
				418		
Total			3,082	6,359	1,392	

Power from Barge Canal at Lockport.—As stated previously, the Barge canal engineers have based their plans upon the delivery of 1,237 cubic feet per second of water at the foot of the Lockport locks. They estimate that with a traffic of 10,000,000 tons per year 162 cubic feet per second will be required for lockage, power and leakage purposes. The net flow around the locks will thus be

1,075 cubic feet per second, which on the 49.1 feet of head available, will give 4,800 horsepower.

The total present capacity of wheel installation is 26 per cent. in excess of the water to be by-passed by the Barge canal. During the non-navigation season all plants could be run. Thus all the water available could be used in the local industries now dependent upon the same source of power.

In case, however, of such use not being for some reason considered desirable, the Barge canal plans permit of the direct development of this power in a very simple and economical manner by a plant at the end of the flume shown on the Barge canal plans terminating the tunnel by-pass.

Table IV shows the installations on Eighteen Mile creek, all of them entirely dependent upon water from the canal, the drainage area of the creek above the canal being only 2.2 square miles. Permission for the diversion of 500 cubic feet per second from Niagara river for use at Lockport has been granted by the Secretary of War. This is a part of the total of 16,600 cubic feet per second thus far granted. Of course this grant will be ineffective unless the State consents to the carrying of this water in the canal. As before stated, no contract or grant by the State has ever been made for the diversion of water from the canal into Eighteen Mile creek.

TABLE IV.

TABLE OF POWERS ON EIGHTEEN MILE CREEK.

LOCATION	Product	Employees	Working hours	Available fall	Working head	Horse-power in use	Horse-power capacity of plant	Months full capacity	Auxiliary power	Remarks
Newfane	Woolen goods	50	24	8.5	8	150	192	11	S. 95	Electric power at night.
Newfane	Lumber and baskets	20	10	13	13	40	120	12	....	Same dam.
Newfane	Flour and feed	2	10	....	13	60	90	12	....	Same dam.
Newfane	Flour and feed	1	10	9	8	45	60	12	....	Same dam.
Newfane	Cider	1	10	9	8	15	15	12	....	Same dam.
Lockport	Electric smelting	20	24	35	34.5	900	1,235	11	S. 10	
Lockport	Fibre ware	200	20	30	29	900	903	11	....	
Lockport	Bar iron	60	24	....	18–14	250	340	11	S. 150	
Lockport	Cover papers	75	24	9	9	200	280	9	S. 680	Water power not sufficient.
Lockport	Paper	100	24	12.3	12	200	300	11	S. 1200	Water power not sufficient.
Lockport	Wood pulp	7	24	14	14	450	495	3	....	
Lockport	Cold storage	10	24	21	20	35	75	12	E. 50	
Lockport	Leather board	10	24	....	24	75	100	11	E. 75	
Gasport	Flour and feed	2	10	17	....	40	70	12	....	
Gasport	Flour and feed	2	10	....	23	40	56	12	....	
Total	....	560	....	....	178	3,400	4,331	....	2,260	

The horsepower in use requires about 210 cubic feet per second of water and the plant capacity 243 cubic feet thus roughly checking the gagings.

Conclusions as to Diversions into Eighteen Mile Creek.— It appears very probable that the State will require 1,237 cubic feet per second or more to operate the canal, and that unless the velocity of flow in the canal above Lockport is increased beyond the value figured upon by the engineers, no water can be diverted into Eighteen Mile creek. The maximum velocity in the entire canal will occur in the section above Lockport, and hence the most damage to transportation would be done by an increase in velocity.

Middleport.

About 100 feet of fall is developed in Jeddo creek below Middleport. The diversion from the canal is small, however, and rests upon no claims of right as far as can be ascertained.

Medina.

Physical Conditions.— The Erie and Barge canals cross the Oak Orchard creek at Medina. When the Erie Canal was first conceived, it was expected to use the waters of Oak Orchard creek as a feeder, and as early at 1811 the diversion of Tonawanda creek into Oak Orchard creek to augment the flow was projected. The connecting ditch was dug in 1824 and enlarged in 1839 and 1840. The feeder ditch is about four and one-half miles long and 38 x 5 in section. The water was originally taken into the canal from behind a dam erected by the State through a feeder channel about 2,000 feet long. Mill owners later erected a dam above the State's dam and diverted the water at a higher level, using the State's channel as a tail race.

In the 1860 enlargement of the canal, the water surface of the long level was raised and instead of raising the State's dam on Oak Orchard creek the mill raceway has since been used as the feeder. As a matter of fact, for many years instead of acting as a feeder this arrangement has been used for withdrawing water from the canal for power purposes. The amount so withdrawn varies with the season, more being withdrawn in the dry season of the year. The supply bill of 1912 carried an item of $23,500 for the repair of the dam on Tonawanda creek and the enlargement of the feeder on Oak Orchard creek.

Oak Orchard swamp is the site of a large drainage project now under way, and it is probable that the low water flow of the stream will be less than ever. The water of Oak Orchard creek and the water diverted from Tonawanda creek into Oak Orchard creek belongs to the State, having been appropriated for canal purposes. The total low water flow below the canal is about 125 cubic feet per second, which will give on the 146 feet of total available fall about 1,500 horsepower of continuous power. The economic development is much larger.

Existing Plants.— The power of Oak Orchard creek is used principally in the generation of electricity. Table V gives the amounts and locations of the installations.

TABLE V.

POWERS ON OAK ORCHARD CREEK.

PLACE	Product of plant	Head feet	Horse-power used	Horse-power capacity of wheels
Waterport	Electricity	33	450	650
Kenyonville	Flour, feed and lumber	12	50	106
Medina	Electricity	85	....	3,000
Medina	Furniture, flour, feed, etc.	9 to 16	230	285
Total	....	146	....	4,041

Other Diversions Western Division.—As indicated by Table II, the diversions at other points than Lockport and Medina are small or have been abandoned.

Rochester.

The Erie canal passes through the principal business section of Rochester and crosses the Genesee on an aqueduct, the elevation of the water surface at the aqueduct being at 513.0. No water is directly diverted from the Erie though there is considerable leakage into the river.

State's Rights in Waters of Genesee River.— Table J., page 290, of Vol. II, First Annual Report of the Conservation Commission shows that the state has a right to 160 cubic feet per second of flow of the Genesee river during the canal season, which right it

bought and paid for and used at various times for the Erie canal. (The 18 cubic feet per second from the Rockville reservoir is omitted, as the reservoir was constructed previous to the awards of 1855).

Barge Canal.— The Barge canal diverges from the Erie canal near South Greece, passing to the south of Rochester (See Plate III). It is to cross the Genesee in a pool formed by a dam with movable crest to be built about 1,300 feet above the Erie aqueduct. The low water elevation of the pool will be 512.6.

We showed in Table I that in order to keep the Barge canal flowing full, the minimum amount of water required at Brockville may be 815 cubic feet per second and the maximum, 1,260 cubic feet per second, and stated afterward that all of the water delivered at Brockville could be put through the canal section to South Greece without interference with navigation.

The requirements of the canal between Brockville and Macedon, exclusive of water for power, are shown in Table VI. These allowances are liberal.

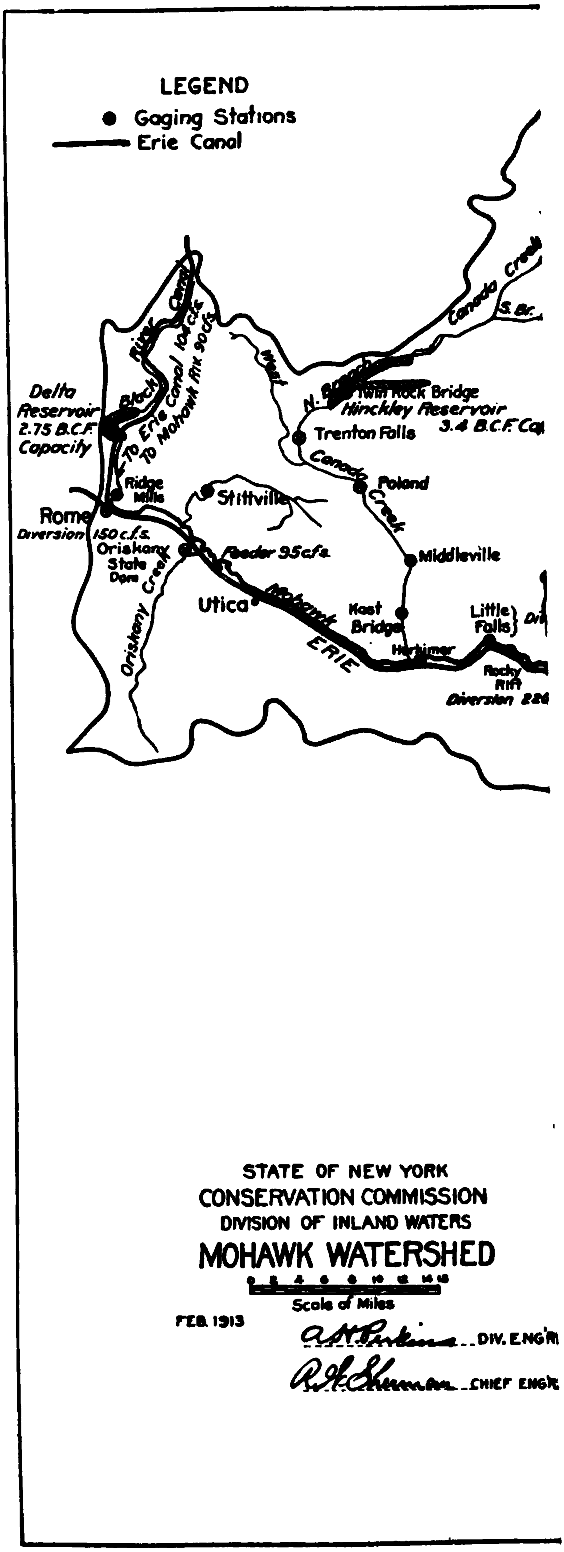
TABLE VI.

WATER REQUIREMENTS OF BARGE CANAL, BROCKVILLE TO MACEDON — DISTANCE 46 MILES.

	Cubic feet. per second
Evaporation, percolation, etc., 3.5 cu. ft. per sec. per mile	161
Leakage at aqueducts, etc.	8
Leakage at lock gates and valves	14
Loss over waste weirs	13
Water for power	0
Water for lockages	140
	336

Water Available from Barge Canal at Rochester for Power.— If only the minimum carrying capacity of the Barge canal be realized, we deduct from 815 cubic feet per second the 336 cubic feet per second of canal requirements east of Brockville given in Table VI and add the 160 cubic feet per second of the flow of the Genesee river acquired and paid for by the State for its Erie

PLATE IV


LEGEND
Gaging Stations
Erie Canal
Delta Reservoir 2.75 B.C.F. Capacity
Black River Canal
To Erie Canal 104 c.f.s.
To Mohawk Rv. 90 c.f.s.
West Canada Creek
S. Br.
N. Br.
Twin Rock Bridge
Hinckley Reservoir 3.4 B.C.F. Cap
Trenton Falls
Canada Creek
Poland
Middleville
Ridge Mills
Stittville
Rome
Diversion 150 c.f.s.
Oriskany State Dam
Feeder 95 c.f.s.
Oriskany Creek
Utica
Mohawk
ERIE
Kast Bridge
Herkimer
Little Falls
Rocky Rift
STATE OF NEW YORK
CONSERVATION COMMISSION
DIVISION OF INLAND WATERS
MOHAWK WATERSHED
Scale of Miles
FEB. 1913
DIV. ENG'R
CHIEF ENG'R

canal, giving 639 cubic feet per second as the minimum amount of water available for power at South Greece.

If the maximum carrying capacity of the canal be realized, the quantity available for power is 1,260 — 336 + 160 = 1,084 cubic feet per second.

Proposed Development at Rochester.— It is proposed to take this surplus water from the Barge canal at the point where it leaves the Erie canal near South Greece, and conduct it through the Erie canal to a point near the river. From thence it would be taken in a pressure tunnel to a plant on the river bank. The head for this development would be 250 feet. With 639 cubic feet per second, about 14,500 H. P. could be realized. This is the probable minimum. With 1084 cubic feet per second, about 25,000 H. P. could be realized. This is a maximum figure and the amount realized will almost certainly be less. It is not possible, with the data available, to estimate this power with any degree of certainty. Attention is called to the fact that this project does not contemplate any changes in the Erie canal nor any increased velocity at critical points over that required for the operation of the canal. (See page 71.)

The 160 cubic feet per second to be taken from the Genesee is available during the navigation season only. During the remainder of the season this will be more than offset by the fact that no water will be required to operate the Barge canal, or at most only a very small amount.

The power at this point will be a steady power available 24 hours per day, 365 days per year. For complete utilization on a commercial load having a curve of the customary shape, it should be supplemented with steam or be used in connection with some power that can be controlled without waste to meet demands. Supplemented with steam running an average of four or five hours per day, a peak load of about double the hydraulic H. P. could be handled.

Report on the Surplus Water Power of the Barge Canal in the Mohawk River Drainage System.

In determining the amount of water power created by the construction of the Barge canal in the drainage basin of the Mohawk

river, the relation of the proposed sources of water supply to the requirements of navigation, as well as to the present sources of supply of the Erie canal, must be considered. That the State, having spent great sums of money in the building of reservoirs and feeders for a sufficient supply of water for the canal, should be entitled to whatever beneficial effect these works would have in regulating the flow of the Mohawk river seems justifiable. It is one of the purposes of this report to show to what extent the low water flow of the Mohawk may be increased and to point out how this increase in flow may be brought about and utilized.

Power is developed on the main branch of the Mohawk river at only two points, namely, Cohoes and Little Falls. A small development owned by the city of Rome at Ridge Mills, three miles above Rome, and just below the Delta Dam, was in use until recently. This plant, used for the purpose of pumping water for the Rome city water supply system, was abandoned upon the completion of a gravity supply system. On West Canada creek there are several developments, which will be more or less affected by the regulated flow which will be brought about by the Hinckley reservoir.

Water Supply of Summit Level of Old Erie Canal.

The Erie canal has a summit level extending from Utica to Syracuse. This level is approximately fifty miles long. The water supply is secured by means of several feeders which divert water from various creeks, some of which are supplemented with storage reservoirs. In addition to these feeders the Black River canal enters the level at Rome, bringing water from the Black River watershed. The Mohawk River is also utilized at Rome as a source of supply. The State Engineer's reports make the statement that in times of low water the entire flow of the Mohawk River at Rome is diverted into the canal. The feeders to the south of the canal beginning at the westerly end of the level are — Orville (Butternut Creek), Fayetteville (Limestone Creek), Chittenango (Chittenango Creek), Cowasselon (Cowasselon Creek), Oneida (Oneida Creek), and Oriskany (Oriskany Creek). No power is developed upon these first five streams between the point of their diversion and Oneida Lake into which they discharge.

There is a small development between the Oriskany feeder and its entrance into the Mohawk. This plant can only run four (4) months with its installation of 134 H. P. on a 12 ft. head.

The minimum yield of these various sources of supply was estimated in the 1901 Barge Canal report by Mr. Emil Kuichling. In 1907 gaging stations were established in all these streams, with the exception of Oriskany Creek, and records have been made of the run-off to date. Fortunately we have the yield recorded for the two exceptionally dry seasons of 1908 and 1909. Up to 1900 the state engineer's reports contained a table of feeders and the quantity of water they furnished the canal. As will be seen by the annexed table these values are much too high and do not bear out the conservative estimate of Mr. Kuichling or the recorded measurements.

TABLE VII.

FEEDER	Creek	Supply furnished as stated in State Engineer's reports previous to 1900	Estimated minimum yield in year of least rainfall, Kuichling, 1901	Recorded minimum monthly flow discharge measure, 1907 to date *	Place of measurement of flow
		Cubic feet per second	Cubic feet per second	Cubic feet per second	
Orville	Butternut	40	29	22	Jamesville
Fayetteville	Limestone	65	21	51	Fayetteville
Chittenango	Chittenango	94	12	46	Chittenango
Cowasselon	Cowasselon	3	1	....	Chittenango
Oneida	Oneida	16	2	16	Kenwood
Oriskany	Oriskany	100	38	30	....
Total	....	318	103	165	

* Total flow in creek must be distinguished from feeder flow.

The amount of water which is allowed to flow southward on the summit level of the Black River canal at Boonville is 11,000 to 13,000 cubic feet per minute or 183 to 217 cubic feet per second. All of this does not enter the canal through the Black River canal, as a large portion passes over waste weirs and enters the Lansing Kill and the Mohawk river. The amount thus lost from the Black River canal can be regained at Rome, however, through the Mohawk river feeder. The minimum supply from the Black River canal at Rome was estimated by Mr. Kuichling at 104 cubic

feet per second. The State Engineer's reports previous to 1900 gave the supply from the Black River canal and Mohawk river as 216 cubic feet per second. A gaging station which has been maintained at Rome above the feeder dam shows a minimum mean monthly discharge of 148 cubic feet per second. This, however, undoubtedly contains considerable water from the Black River canal. However, assuming Kuichling's minimum for the canal 104 cubic feet per second and 148 cubic feet per second for the river, the total 252 cubic feet per second would be the minimum yield at Rome. An average of sixteen gagings in the Black River canal, made in 1907, 1908, and 1909 show 110 cubic feet per second flowing in the canal, so that disregarding the portion of the Black river canal water which is incorporated in the flow of the Mohawk at Rome it is probably safe to say that the supply from the canal itself was 104 cubic feet per second, while whatever water was needed up to the limit of the stream was abstracted from the river through the feeder.

As to the Oriskany feeder, Mr. Kuichling estimated a minimum yield of 38 cubic feet per second. The State Engineer's reports previous to 1900 stated 100 cubic feet per second as the supply. Gagings in the creek were maintained from 1898 to 1900, and the minimum flow recorded during this period was 73 cubic feet per second for a mean monthly flow.

This sums up the water supply to the summit level of the old Erie canal. It may be said that several measurements have been made in the level itself both east and west of Rome, and also at Syracuse. These gagings, some of which are not simultaneous, are not sufficient in number, so that dependence may be placed upon them. They may be found in the 1907, 1908 and 1909 reports of the State Engineer and Surveyor.

Water Supply of Rome Summit Level of Barge Canal.

All the sources of supply for the Rome summit level of the old canal are to be retained for the Barge canal. The water from the feeders to the south of the canal between Rome and Syracuse will be brought eastward to New London where it will be discharged into the Barge canal. The Black River canal will enter the Barge

canal at Rome via the Erie at its intersection with the line of the Barge canal. The Oriskany feeder will enter the Mohawk river and summit level at Oriskany, the old canal being abandoned between Oriskany and Rome.

In addition to these sources, the water of the Mohawk river will be stored by means of the Delta dam, the reservoir having a total capacity of 2.75 billion cubic feet, and will be capable of regulating the flow of the Mohawk at the dam, so that 435 cubic feet per second will be available in a season of minimum rainfall. The low water summer flow of the Mohawk at this point was 165 cubic feet per second in 1908. This reservoir therefore will add 270 cubic feet per second to the low water flow in the driest year if operated to give a uniform flow the entire year, as nearly as can be done. The Hinckley reservoir on West Canada creek will store 3.4 billion cubic feet of water on this stream, and this water will be diverted by means of a feeder from below Trenton Falls to Nine Mile creek near South Trenton, whence the water will be taken to the summit level. The capacity of this feeder is 350 cubic feet per second, and this is the amount which it is proposed to divert. By utilizing only the water stored in this reservoir 161 cubic feet per second could be diverted from the watershed for the supply of the canal during a period of 244 days. As a matter of fact, however, no just claim could be made against the State for the diversion of any water which it was impracticable for the riparian owners below the point of diversion to utilize. An estimate has been made of the amount of water that could be diverted, including stored water, and not disturb the natural flow of the stream when it was below 630 cubic feet per second, the flow which is available for 60 per cent. of the time, and a limit beyond which it is usually considered to be impracticable to develop power. This estimate shows that using the reservoir to produce as nearly as possible a steady flow throughout the year, as proposed by the Barge Canal engineers, such flow would be 550 cubic feet in a year of minimum rainfall. The natural flow in a year of minimum rainfall is 180 cubic feet per second. Hence the net addition to the low water flow of the Mohawk from this source is 550 — 180 = 370 cubic feet per second. The diversion contemplated is 350 cubic feet per

second; and an average of 320 cubic feet per second could be diverted without interfering with the natural flow of the stream when below the 60 per cent. point.

Assuming, therefore, that the reservoirs are to be operated to give uniform flows as described, the net additions to the low water supply of the Rome level of the Barge canal and Mohawk river is thus: 270 cubic feet per second + 370 cubic feet per second = 640 cubic feet per second.

The requirements of the Erie canal lockage, leakage through gates, etc., at Syracuse have averaged about 95 cubic feet per second. The similar requirements of the Barge canal at New London will be about 130 cubic feet per second or the westward flow from the Barge canal will be about 35 cubic feet per second greater than the westward flow of the Erie. Seepage and other losses will not be materially different in the two systems.

Thus the net effect of the new Barge canal system on the low water flow of the Mohawk river, assuming that the Delta storage is used to produce a uniform yearly flow at its outlet, that the Hinckley reservoir is used to produce a regulated flow for the Nine Mile creek diversion in the manner previously described, and that all surplus is turned eastward, will be an increase of 640 — 35 = 605 cubic feet per second or say 600 cubic feet per second. If the reservoirs are used for supplementing the stream flow at times of minimum flow only, then the corresponding addition to minimum flow will be much greater.

The question of the amount of power which can be developed at the respective sites will now be taken up.

Delta Dam.

This development will be made the subject of a separate report, and will not be gone into detail here except to state the amount of power. Two thousand three hundred H. P. can be developed at the dam site on a 60 per cent. of the time basis, but due to the fluctuating head it will be necessary to install 2 — 2300 H. P. units, making a total installation of 4,600 H. P. The minimum power available would be 1,200 H. P. This development assumes that only 2.58 billion cubic feet of the 2.75 billion cubic feet of storage

available is used. This will decrease the regulated flow, however, only 10 cubic feet per second, making it 425 instead of 435. By passing the water from the Black river feeder through the reservoir or making a separate installation therefor, about 600 H. P. more would be available.

Nine Mile Creek.

There are two sites for the development of power on Nine Mile creek,— one at the end of the feeder canal where the water will be dropped 47 feet into the creek, and another which can be made available by the construction of a 30-foot dam just below the village of Stittville. A canal about two miles long from this dam will enable a concentration of 100 feet of head (net).

These developments, the former called "A" and the latter "B" for convenience, are capable of producing the following power with 350 second feet diversion:

	"A"	"B"	Total
60% of time power	1,500 H. P.	3,920 H. P.*	5,420 H. P.
Continuous power.	1,500 H. P.	3,245 H. P.*	4,745 H. P.

Little Falls.

The estimate of the power created at Little Falls is based on the following assumptions: The State is entitled to the amount of water now used by the Erie canal. It will also be entitled to all the increase in the natural flow of the river due to storage in the Hinckley and Delta reservoirs, as well as all other surplus water which may come from sources primarily appropriated for canal purposes. In addition to this it may use whatever flow is in excess of 60 per cent. of the present natural flow of the stream, that is, all water flowing above 1,630 cubic feet per second.

The present amount of water by-passed for canal purposes is, according to the best information obtainable, 150† cubic feet per second diverted through the Little Falls feeder from the pond above the State dam, and about 60† cubic feet per second brought eastward in the canal itself, making a total of 210† cubic feet per second. The requirements for the Barge canal for lockage, etc., are 235 cubic feet per second per 10,000,000 tons traffic, or an in-

* Includes flow of Nine Mile creek at Stittville.

† Average of gagings in feeder and canal. Reports of State Engineer and Surveyor, 1907, 1908, 1909 and 1910.

crease of 25 cubic feet per second over the present use. The amount of stored water which would have been available during a period extending from June, 1907, to December, 1911, plus the excess flow 40 per cent. of the time less the 25 cubic feet per second increase in use for canal purposes, showed that 400 cubic feet per second would have been available for 60 per cent. of the time. On 40.5 feet of head with 80 per cent. efficiency there would then be available 1,470 H. P. for 60 per cent. of the time.

It was shown above that the addition to the low water flow of the Mohawk due to the Delta and Hinckley reservoirs operated throughout the year will be 600 cubic feet per second, leaving a net 575 cubic feet per second added for power purposes at Little Falls. This is not added continuously, however.

Mindenville.

The next possible site for the development of power is at Mindenville. The canal line after traversing the river for several miles below Little Falls enters a land line which is about 4.1 miles long and is locked down into the river again at Mindenville. This pool is maintained by the "Rocky Rift" dam which is of the needle type of movable crest. The fixed crest is at elevation of 319.5, but the water level is maintained in low water by means of gates at elevation 322.5. The head available at Mindenville is normally 20.5 feet, but is reduced to 15.1 at maximum navigable stage. The land line is of standard section, 75 feet bottom, 2 on 1 slope and, as at Lockport, could carry 1,237 cubic feet per second without detriment to navigation. The flow available 60 per cent. of the time is 1,700 cubic feet per second, the minimum flow being 925 cubic feet per second. The power available would then be on the basis of 1,237 cubic feet per second for maximum flow; normal head 2,300 H. P. or 1,700 H. P. for 15.1 feet head. The continuous power available with 20.5 feet head would be 1,722 H. P.

The Crescent and Vischer ferry developments are not taken up here, as they have been more fully described elsewhere in this report. At these two sites, it is possible to install economically at least 24,000 H. P.

The question of the development of power at the movable dams

is one, the solution of which has not been attempted. They have been designed to leave no obstruction in the river from the time navigation closes in the fall until it opens in the spring.

Cohoes.

The history of the development of power on the Mohawk river at Cohoes begins in 1826, when the Legislature authorized the Cohoes company to take water from the Mohawk river subject to the needs of navigation, for the purpose of developing water power which was to be sold to various manufacturing interests. Barge Canal Bulletin Series III No. 4, contains in the form of memoranda and opinions by the State Engineer, Attorney-General, Advisory Board of Consulting Engineers, the Canal Board, the history of the operation of the Cohoes company. The attempt of the Cohoes company to obtain by legislation the surplus power created by the Crescent dam met with the disapproval of all of the above mentioned officials, and the bills introduced in their favor failed to pass.

The use of water by the Cohoes company is at present very uneconomical. There are hydraulic canals leading from the dam through which the water is led to the wheels of their customers, these canals being at five different levels, furnishing 18, 25, 22.7, 14 and 24 feet heads respectively, making a total of 103.7 feet fall between the crest of the dam and the tail water above the State dam which maintains the pool of the Champlain canal across the Mohawk river.

It is understood that the Cohoes company has made plans for the construction of a hydro-electric plant capable of using the entire head, and by this method furnish electric energy to their customers instead of water. Upon the 103.7 feet head available, with the present natural flow of the river, it is possible to develop 60 per cent. of an average year — 33,000 — 24-hour H. P.

Just how much water is used to supply the present flight of locks at Cohoes has not been determined. The amount of water taken into the canal at the Rexford Flats feeder based on current meter discharge measurements made at various times is, on the average, about 212 cubic feet per second.* It has been stated

* See State Engineer's Report 1907, p. 483; 1908, p. 560; 1910, p. 503.

that the diversion is at its maximum in August, and averages about 270 cubic feet per second. In addition to this amount there is 50 to 100 cubic feet per second flowing in the canal above the feeder. As the estimated quantity necessary to supply the locks on the Waterford flight is only 200 cubic feet per second it is apparent, assuming the present use to be as much as stated, that the State will not use any more water for navigation purposes than at present, even if there should be considerable waste of water in operating the locks.

Inasmuch as there will be no more draft on the river for water for canal purposes than there is at the present time, the amount of water which will be made available due to storage regulation by canal works, will be of the same amount as at Little Falls (all regulation occurs above Little Falls). Therefore, carrying out the idea as to the right of the State to develop this stored water, as well as water flowing in excess of the amount which the present private users can utilize (assumed to be that in excess of the flow available 60 per cent. of the time), there would be available for 60 per cent. of the time 3,800 H. P. of 24-hour power on the 103.7 feet head.

Making a summary of the power which can be developed on the Mohawk watershed in connection with the construction of the Barge canal, we have:

TABLE VIII.

SUMMARY OF POWER ON MOHAWK RIVER CREATED BY BARGE CANAL CONSTRUCTION.

PLACE	Head available (feet)	Horsepower capacity of installation, 60 per cent of time
Delta	30–70	2,300
Nine Mile Creek:		
A	47	1,500
B	100	3,920
Little Falls	40.5	1,470
Mindenville	20.5	2,300
Vischer Ferry	27	*24,000
Crescent	30	
Cohoes	103.7	3,800
Total	....	39,290

* Peak load capacity, 35,000 horsepower, with a steam auxiliary of 16,000 horsepower.

PRELIMINARY REPORT ON POWER DEVELOPMENT AND TRANSMISSION IN THE CAPITAL DISTRICT.

Territory to be Covered.

The term "Capital District" as used herein is intended to cover the region within five miles of the cities of Albany, Troy and Schenectady. The best sources of power from the Barge canal lie near the center of the district and transmission of power at standard generator voltage (11,000 volts) without the intervention of step-up and step-down transformers is economically practicable. The area served could be greatly extended by transforming up to higher voltages should it be thought wise to carry the developments to the economic limits at once and transmit further distances to such cities as Amsterdam, Fonda, Johnstown, Gloversville, Saratoga, Ballston and Hudson. The local sources of power when developed to full economic capacity are believed to be amply sufficient to serve for some time this larger territory, basing the probable requirements upon the experience of privately owned systems in this State. In this report, however, we confine ourselves to the Capital District as first defined and figure upon local sources of power being reserved for local uses.

Large Local Sources of Cheap Power.

Table IX gives the local sources of undeveloped power which answer to the requirements of being large and cheap both in first cost and delivery of power. Plate V shows their position in the Capital District. Their location near the center of the district is one of the factors contributing to the cheapness with which power can be supplied to the district. The Capital District is favorably situated to receive cheap power from other large and more distant sources, such as the Sacandaga and other Hudson powers, but the local supplies mentioned are the cheapest and should be ample for a long period to come.

Stream Flow Data.

Table IX is based upon stream flow records at Dunsbach Ferry on the Mohawk extending over a period of thirteen (13) years, and at Mechanicville on the Hudson extending over a period of

twenty-four (24) years. The developments proposed are for regulated stream flows, the Mohawk regulated by the Hinckley and Delta reservoirs and the Hudson by the Sacandaga reservoir. Our studies of the requirements of the Barge canal show that the Hinckley and Delta reservoirs could be used to regulate the streams at the reservoir dam sites the year around and still furnish ample water for canal purposes during the nevigation season, and such a use of the stored water is contemplated herein. This is due to the fact that stream flow data obtained since the original estimates for the Barge canal water supplies show that the run-off of West Canada creek is much greater than was assumed in Kuchling's original estimates.

In the scheme as worked out, developments at Waterford and Troy would not be made until the demand had exceeded the full economic capacity of Crescent and Vischer Ferry with their steam auxiliary (35,000 H. P.). The construction of the Sacandaga reservoir will doubtless precede the development of so large a market demand as 35,000 H. P. within the Capital District.

PLATE VI

STATE OF NEW YORK
CONSERVATION COMMISSION
DIVISION OF INLAND WATERS

POWER PERCENTAGE OF TIME CURVES SHOWING THE AVAILABLE POWER AT CRESCENT AND VISCHER FERRY DAMS

MAY 1913. A.H. Perkins DIV. ENG'R.

R.W. Sherman, CHIEF ENG'R

		AVAILABLE POWER 30' HEAD			
		Natural Flow		Regulated Flow	
Percentage of time of average year		50%	60%	50%	60%
Capacity of plant	H.P.	12420	9420	12690	10200
Energy available from water	H.P. Yrs.	9580	7920	10150	8790
Capacity of auxiliary required	H.P.	10770	7770	8790	6300
Energy required of auxiliary	H.P. Yrs.	2840	1500	2540	1410
Power added by regulation	H.P. Yrs.			420	360
Power available with minimum flow	H.P.	1650	1650	3900	3900

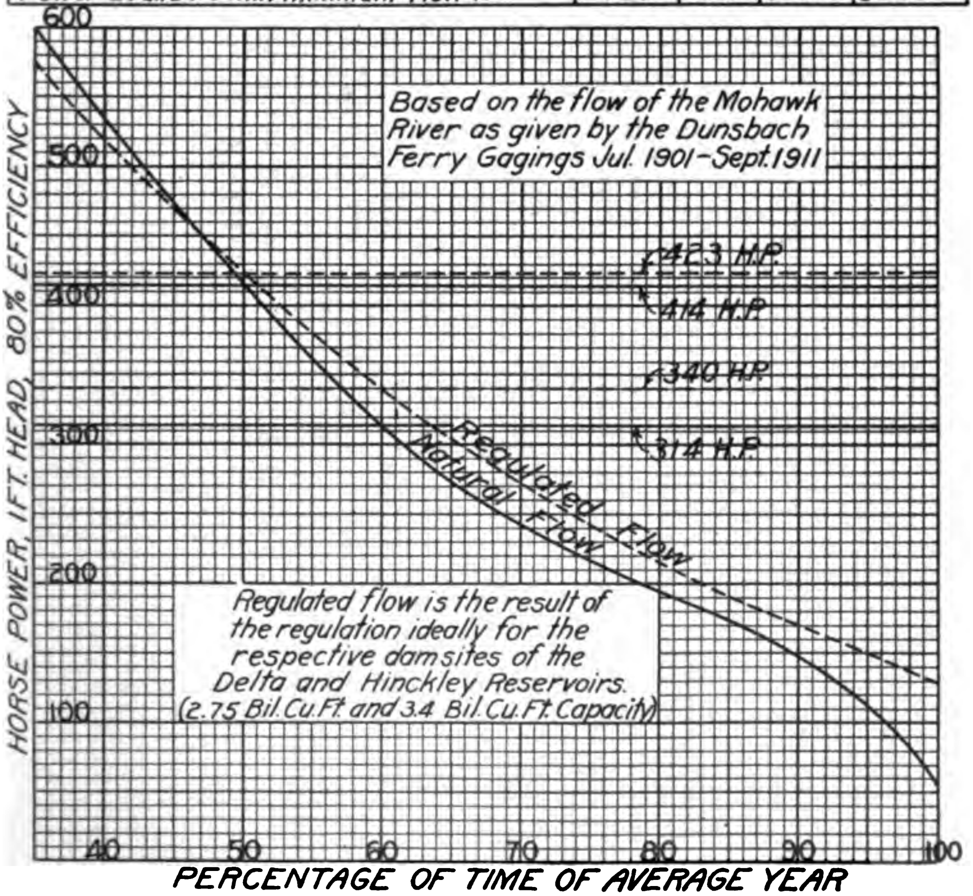


TABLE IX.

LOCAL SOURCES OF POWER IN THE CAPITAL DISTRICT.

PLACE	Head	Economic Capacity of Hydraulic Development, Horsepower		Capacity of auxiliary horsepower	Economic Peak Load Capacity, Horsepower		Cost Per Horsepower Per Year Delivered		Existing developments	Distance from Albany	Distance from Troy
		Without auxiliary	With auxiliary		Without auxiliary	With auxiliary	Without auxiliary	With auxiliary			
										Miles	*Miles*
Vischer Ferry	*30′	6,000	12,000	8,000	6,000	17,500	$6 88	$6 72	......	12.00	13.50
Crescent	30′	6,000	12,000	8,000	6,000	17,500	6 88	6 72	......	11.60	6.25
Waterford	14′	3,800	7,600	7,000	3,800	12,600	7 30	9 22	......	13.00	6.50
Troy	13′	6,000	12,000	10,000	6,000	20,000	....	....	2,450	6.50	....
Total	....	21,800	43,600	33,000	21,800	67,600					

* With 3′ flashboards

Plant Capacities and Power Costs Crescent and Vischer Ferry.— The power percentage of time curve at Crescent shown on Plate VI gives for 60 per cent. of the time a plant capacity of about 10,000 H. P., and for 50 per cent. of the time 12,700 H. P., and for continuous power a peak capacity of 7,800 H. P., and like amounts are available at Vischer Ferry, the pondage being unlimited for all practical purposes at both places. With these figures as a preliminary guide, estimates of yearly costs have been made for different installations and peak loads as shown in Table X. The amount of steam produced power required for each case was arrived at by comparing the actual monthly load curves of a company supplying a large city and surrounding territory in this State with the monthly stream flows as given by past gagings. The yearly costs of power from different developments were then computed. Table X gives the results of these studies.

TABLE X.

POWER COSTS FOR VARIOUS INSTALLATIONS CRESCENT AND VISCHER FERRY.

CASE	INSTALLATIONS, HORSEPOWER		Peak capacity, delivered horsepower	Yearly cost per horsepower of peak	Cost per horsepower of last 8,900 horsepower	Cost per horsepower, including dams, water rights, flowage, etc., at $2,000,000, and 8 per cent profit on total investment
	Water	Steam				
1	24,000	24,000	42,600	$7 23	....	....
2	24,000	20,000	40,500	6 97	$7 87	....
3	24,000	16,000	31,600	6 72	....	$14 23
4	24,000	16,000	22,600	7 70	....	....
5	18,000	16,000	31,600	6 84	....	....
6	12,000	0	10,600	6 88	....	24 58
7	12,000	0	10,600	*5 49	....	....

* This case is theoretical only, being based upon the supposition of no expenditures for future expansion, together with some other limitations.

While the exact shape of the load curve cannot be predicted, a combination of urban loads in any locality will not vary much in form. The relation of the peak to the average load and the distribution of the load throughout the day and the year will be about the same in all plants carrying a diversified city load.

The limit of the peak which can be carried by the Crescent and Vischer Ferry plants with 24,000 H. P. of water wheels and 16,000 H. P. of steam auxiliary is about 38,000 H. P. Any further addition of 4,000 H. P. of steam power (the total plant does not add at all to the peak capacity and saves very little coal. The plant combination of 24,000 H. P. of water and 16,000 H. P. of steam gives cheapest power when operated for a peak of about 35,000 H. P., and at the same time such operation leaves a reserve capacity of water wheels. It is to be noted that a further addition of 4,000 H. P. of steam power the total plant being operated at 39,500 H. P. peak) gives a cost per H. P. for additional peak capacity above 31,600 H. P. but little in excess of the cost of power from a 3,800 H. P. development at Waterford without auxiliary ($7.87 as against $7.30). The steam power is the more desirable because of its adding to the reliability of the system.

Market Present Supply.— The Capital District is now supplied with water power from the Spier Falls, Mechanicville, Troy, Waterford, Cohoes, Schaghticoke, Johnsonville, and some other small developments. Table XI shows the amounts of these developments, all of which are supplemented with steam power located at various points.

TABLE XI.

WATER POWER NOW SUPPLYING THE CAPITAL DISTRICT.

Installation.

Place	H. P.	River
Spier Falls	25,000	Hudson
Mechanicville	5,700	Hudson
Troy	2,500	Hudson
Troy	1,150	Poestenkill
Waterford	650	Mohawk
Cohoes	12,100	Mohawk
Schaghticoke	20,000	Hoosick
Johnsonville	6,000	Hoosick
	73,100 H.P.	

Of this grand total probably not less than 40,000 to 50,000 H. P. of peak load is used in the Capital District. With the price for power maintained at present levels these powers with their auxiliary steam plants are doubtless ample for the present needs of the district.

Table XII gives the present rates for power and lighting in three cities of the district. Examination of these rates for lighting indicates that in Troy and Albany nearly all the consumers must pay the maximum rate. For instance, before a lower rate is secured the monthly bill must exceed $100 in Albany; $140 in Troy. Similarly for power, the mass of small consumers pay the maximum rates.

The effect of rates upon the number of consumers is shown in Table XIII. Troy, having the highest rates, has one consumer per 30 inhabitants. Albany, whose rates are next lower, has one consumer for every 20 inhabitants; and Schenectady, whose rates are lowest has one consumer for every eight inhabitants.

It is shown by numerous examples that decrease in price results in increase in use, and one engineer has even formulated an equation expressing the relation between price and consumption. To endeavor to determine in advance, however, the probable market in a given district was shown to be entirely impossible by the work of the Ontario Hydro-Electric Commission, and we have not attempted it beyond ascertaining the public needs of the municipalities and assuming that 10 per cent. of the private lighting, both gas and electric, and 10 per cent. of the steam power in use would come to the proposed system. Table XIV shows the requirements under such an assumption. Attention is called to the large pumping loads. Albany spends about $80,000 per year without any allowances for interest, depreciation or extraordinary repairs, Cohoes, $20,000, and Schenectady $25,000 per year for power for pumping water. These loads, if properly handled, will keep the power factor and the load factor high in the proposed system.

TABLE XII.

RATES FOR ELECTRICITY IN THE CAPITAL DISTRICT.

Albany.

WATT HOURS PER MONTH	LIGHT — Rate — Cents per 1,000 Watt hours	WATT HOURS PER MONTH	POWER — Rate — Cents per 1,000 Watt hours
0 to 1,000,000	10	39,000	10
1,001,000 to 2,000,000	8	78,000	8
2,001,000 to 3,000,000	7	155,000	5
3,001,000 to 4,500,000	6	310,000	4
4,501,000 to 6,000,000	5	775,000	3½
6,001,000 to 10,000,000	4	1,550,000	3
10,001,000 to 15,000,000	3½	2,325,000	2¾
15,000,000 and over	3	3,100,000	2½
		6,200,000	2¼
		15,500,000	2
		15,500,000 and over	1¾

Troy.

WATT HOURS PER MONTH	LIGHT — Rate — Cents per 1,000 Watt hours	SIZE OF MOTOR HORSEPOWER	POWER — Rate — Cents per Kw. hour
0 to 1,400,000	10	0 to 1	10 cents
1,400,000 to 2,000,000	9	1	$1 per month plus 4½
2,000,000 to 3,000,000	8	2	2 per month plus 3¾
3,000,000 to 4,000,000	7	3	3 per month plus 3½
4,000,000 to 5,000,000	6	5	5 per month plus 3
5,000,000 to 6,000,000	5	7½	7 50 per month plus 3
Over 6,000,000	4½	10	10 00 per month plus 2¾
		15	15 00 per month plus 2½
		20	20 00 per month plus 2
		30	30 00 per month plus 2
		40	40 00 per month plus 1¾
		50	50 00 per month plus 1½

Schenectady.

KW. HOURS CONSUMED	LIGHT — Net rate per kw. hour, cents	Power
0 to 30	9.	The rate for power depends upon the number of kw. hours consumed per horsepower of installation per month, and varies from 6.3 cents down to 3.1 cents per kw. hour with a minimum charge of 50 cents per month per horsepower of motors larger than 2 horsepower.
90	7.8	
210	6.94	
1,200	6.42	
2,000	5.61	
3,000	5.24	
4,000	4.94	
4,500	4.79	
5,500	4.54	

TABLE XIII.

INVESTMENT AND INCOME OF LIGHT AND POWER COMPANIES IN THE CAPITAL DISTRICT.

(From Public Service Commission reports.)

CITY	Population served	Total fixed capital December 31, 1910	Total annual revenue sale of light and power	Number of consumers	Fixed capital per capita	Revenue per capita	Number of inhabitants per consumer	Revenue from public lighting	Revenue from public power
Albany	100,000	$1,301,800	$500,100	5,051	$13 01	$5 00	19.8	$101,134	$2,900
Troy	76,000	1,268,473	277,511	2,541	16 70	3 65	30.0	72,917	....
Schenectady	*96,000	2,410,000	455,374	12,165	25 10	4 75	7.9	59,444	†26,746
Total	272,000	$4,980,273	$1,232,985	19,757	$18 30	$4 57	13.8	$233,495	$29,646

* Includes territory served adjacent to city.

† Used in water works. Steam power for pumping costs Albany $80,000 per year without allowance for interest, depreciation or extraordinary repairs. Electricity is stated to cost Cohoes about $20,000 per year, while Schenectady pays $20,746 per year as shown. The total of these three items is $126,746 per year. See Table XIV.

TABLE XIV.

POWER REQUIRED IN CAPITAL DISTRICT.

(See preceding text for basis of estimate)

	Municipal street lighting (All)	Municipal buildings light, heat and power (All)	Commercial lighting 10%	Commercial power 10%	Replace steam power	Total K. W.	Municipal pumping H. P.
Albany	400	†167	730	500	820	2,617	1,500
Rensselaer	33	....	‡60	......	50	143	75
Watervliet	75	25	‡217	......	49	366	150
Troy	400	54	381	112	1,050	1,997	....
Green Island	27	1	*46	......	......	74	125
Waterford	25	3	13	......	......	41	80
Cohoes	100	†6	‡130	......	228	530	....
Schenectady	422	†56	477	771	2,360	4,086	1,200
						9,854 = 13,140 H. P.	

* Estimated.
† Does not include pumping water supply.
‡ Includes power and light.

The prices which could be made to power users for power from these developments by the State, when taken in connection with the transportation facilities of the district, should be sufficient to gradually create an increased demand for power in the district.

Proposed Order of Development.— The developments should be carried on so as to keep the supply just ahead of the demand, keeping the capital investment at the lowest point possible, but at all times building with reference to future extensions. Examining Table XIV it appears probable that a development of 9,000 H. P. at Crescent and 6,000 H. P. at Vischer Ferry, with transmission lines of half the ultimate capacity, would be all that would be warranted at present. The power house and intake works would be of sufficient size to double the capacity when necessary. The transmission being at only 11,000 volts, a wood pole line could be used, and division of the line into four circuits — two per line — would entail but little extra cost, and would be desirable for security in operation. The second step would be the addition of a unit of 8,000 H. P. of steam plant, then further additions to water power at Crescent and Vischer Ferry up to the economic limit of 12,000 H. P. in each plant and finally steam power to a total of 16,000 to 20,000 H. P. When these developments have been completed, further demands may

be met by developments at Waterford and the steam plant, step by step.

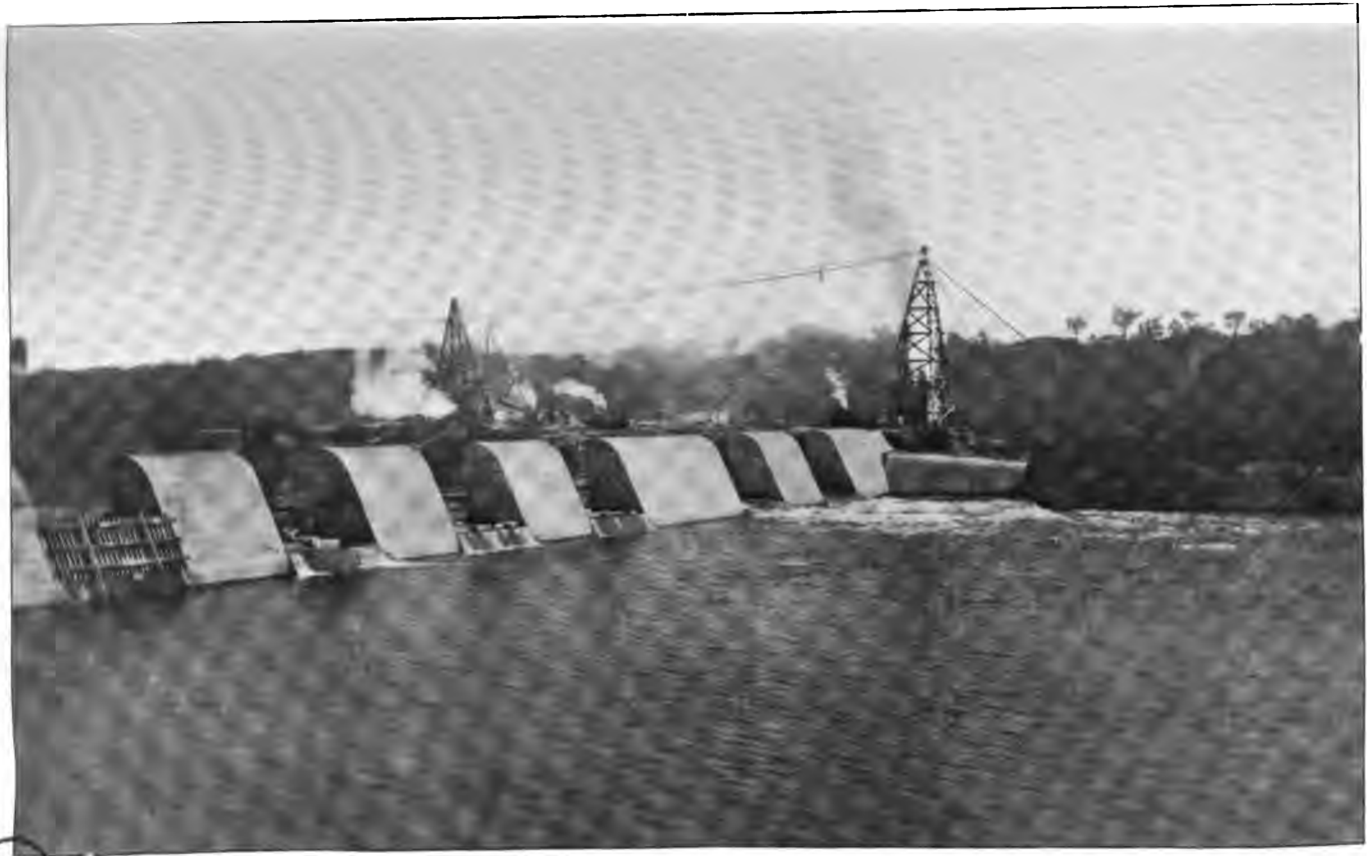
Description of Proposed Plant at Crescent.— The conditions at Crescent resulting from the construction of the Barge canal dam are very favorable for the construction of a power plant. A natural forebay cuts down excavation costs, and at the same time allows the plant to be in a location well protected from ice and debris and the undermining action of water flowing over the dam. The rock near the surface affords the solid foundations so desirable for moving machines.

Across the entrance to the natural forebay there will be constructed a reinforced concrete ice and debris deflector with twelve (12) submerged openings.

From the forebay a short canal leads to the trash racks and gates. Stop log grooves are provided in front of the trash racks, so that they may be inspected or removed if required. Anchor ice will not be troublesome at the end of such long ponds as exist above Crescent and Vischer Ferry. Passing the gates the water enters the wheel pit.

The whole plant is of standard type so that detailed description is not considered necessary. The preceding statements will indicate that only the best and most substantial installation consistent with reasonable first cost is contemplated.

Standby.— One of the advantages of a widespread distribution of power is that charges upon duplicate apparatus for standby can be cut down to a very small percentage. In these plans, economic considerations make it desirable to install some excess steam power, and there is thus a margin for water power standby upon the completion of full developments for 35,000 H. P. peak. The disabling of the steam plant at the time of peak load in November and December would mean a partial shut-down, however. By the time a load sufficiently great to call for steam auxiliary is secured, however, it is believed that the Sacandaga power and a general system may be in operation, and the load due to any crippled apparatus may be thrown on the general system. One generator set for standby has been provided for in the estimates for the first stage of the development.



Hydraulic Development — Mohawk River.
Vischer Ferry Dam, April, 1913.

Transmission Lines.—Aside from the subdivision into separate circuits, as previously mentioned, the transmission line presents no unusual features. The canal bank affords a right of way for much of the proposed wood pole lines on State property without cost.

The lines were computed to deliver the power to each sub-station as follows: (See Plate V for location of sub-stations.)

COMPLETE INSTALLATION	Water power only	Complete plant	Water power only
No. 1, 2,500 K. W.	800 K. W.	No. 3, 7,300 K. W.	2,400 K. W.
No. 2, 3,500 K. W.	1,200 K. W.	No. 4, 10,700 K. W.	3,600 K. W.

The power required at different points will undoubtedly be ultimately very different from these quantities. The sub-division of the lines and the construction by stages, as proposed, will enable the power to be put where it is required as it is called for without unnecessary expense. The cost of the lines will not be materially increased by the sub-division.

Vischer Ferry Plant.—With 3-feet flashboards the head at Vischer ferry will be the same as at Crescent. Such flashboards are considered entirely practicable, and the large pondage area available above the dam makes them very desirable. The maximum drop in head due to the use of pondage under the operating conditions assumed would be 0.65 feet. The available stream flow is slightly greater at Vischer Ferry than at Crescent, due to no water being used for power development for the Barge canal. The Vischer Ferry plant will, as far as practicable, be a duplicate of the Crescent plant. The only difference will be in the intake and forebay.

Steam Plant.—Although drawings have not yet been made for the proposed steam plant, the estimate will be recognized as a fair one for a plant consisting of 5,000 K. W. (nominal) turbo generator units. Mechanical stoking and induced draft are desirable in order to increase the responsiveness of the plant to sudden demands, and these have been included.

Estimates.— The estimates for capital cost and operation have been based upon the design as described. They are liberal and power can be delivered under the conditions assumed within the prices named.

The estimates for the Troy and Waterford power were not prepared in as great detail as the others. They are useful, however, in this connection for purposes of comparison.

Reason for Low Cost of Power.— Anyone familiar with the costs of power production might, if he did not stop to look for the reasons, think that the extremely low prices given by the estimates were an indication of gross underestimating. In order to preclude such a hasty judgment, the cost of delivered power was computed for the Crescent and Vischer Ferry plants upon the assumption that the cost of the dams paid for out of the Barge canal fund was included in the capital costs, and that a net return of 8 per cent. upon the total investment should be earned. All other assumptions remained as before. These results are included in Table X. In case (3) instead of \$6.72 per H. P. per year the charge would be \$14.23, and in case (6) instead of \$6.88 per H. P. per year the charge would be \$24.58. When one considers that these are the prices for peak load power under a yearly load factor of about 47 per cent., and that no allowance was made for land damages or purchase of rights, it is clear that without the costless dams and State credit these projects would not be commercially attractive, and the reasons for the low estimated cost are apparent.

Total Estimates of Capital Costs for Capital District Power.

A. Water power without auxiliary.

Crescent 9,000 H. P. and Vischer Ferry 6,000 H. P. with provision for 12,000 H. P. at each place when required. 10,600 H. P. delivered to sub-stations at 11,000 volts.

2 water power plants complete..............	\$537,000 00
Transmission lines	75,000 00
Total	\$612,000 00

Hydraulic Development — Mohawk River.
Gates at North End of Vischer Ferry Dam.

B. Water power with auxiliary.

Crescent and Vischer Ferry 12,000 H. P. each. 16,000 H. P.** steam plant located near Barge canal terminal, Albany. 30,600 H. P. delivered to substations at 11,000 volts.

2 water power plants	$676,000 00
Steam plant	694,000 00
Transmission lines	200,000 00
Total	$1,570,000 00

Operating Costs — Capital District Power.

A. Crescent and Vischer Ferry, developing peak load of 6,000 H. P. each, delivering 10,600 H. P.

Interest 3½%...... Depreciation 2%.... Repairs 1%........ Amortization ¾%...	7¼% on $612,000.00..	$44,400 00
Oil waste and supplies		1,500 00
General office expenses and patrol............		10,500 00
Labor		13,000 00
		$69,400 00
5% for contingencies		3,500 00
Total yearly cost of power		$72,900 00 = $6.88 per H. P.

B. Crescent and Vischer's Ferry, 12,000 H. P. each; steam auxiliary 16,000 H. P. Delivering 31,600 H. P.

Interest 3½%...... Depreciation 2%.... Repairs 1%........ Amortization ¾%...	7¼% on $1,570,000.00.	$113,800 00
Oil, waste, and supplies		4,500 00
Coal (2,000 H. P. yrs. per yr. at $22.50)....		45,000 00
General office expenses and patrol...........		10,500 00

**Overload capacity.

Labor water plants	$14,400 00
Labor steam plants	13,800 00
	$202,000 00
Contingencies 5%	10,100 00
Total yearly cost of power	$212,100 00= $6.72 per H. P.

Distribution Within the Cities.—A distribution plant and complete street lighting system for a city the size of Albany will cost about $500,000 and the rates for house lighting could be at least half those charged at present. The rates for power could be about $20 to $25 for 12-hour power from such a system, and if a manufacturers' district be formed taking at one spot 5,000 to 10,000 H. P., the price need not exceed that given for delivery to the municipal sub-stations; viz., $7 to $10 per H. P. per year.

Conclusion.— The construction of the Barge canal will result in the creation of four large powers near the center of the Capitol District, from which power can be delivered to sub-station bus bars at Albany, Schenectady, Troy and Cohoes for distribution in all the cities of the district at a remarkably cheap price. After allowing for extra investment necessary to keep ahead of the market demands, this price at the bus bars need not exceed $7 to $7.50 per H. P. of peak load per year.

The amount of power is ample to supply growth in demand in the district for a long time to come.

The capital investment of the State necessary to complete the first stage of the installation and supply the present needs of the cities, with full provision for future expansion, is less than $625,000.

After allowing for distribution costs within the cities, prices for power and light can be from one-half to one-third the prices charged at present.

Power delivered to special districts in large blocks need not exceed in cost that delivered to the municipal sub-stations, viz., $7 to $10 per H. P. of peak load per year with 50 per cent. load factor.

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NIAGARA RIVER.

General Statement.— The Niagara river drains an area of 255,000 square miles, of which 151,500 miles are United States territory. The average annual precipitation on this area is 31 inches, of which 11 inches run off through the Niagara river, giving an average flow of 212,000 cubic feet per second. This flow would be practically constant were it not for the effects of winds on Lake Erie and ice in the channel of the river. A combination of these effects has been known to shut off the flow so that "fifty years ago, before any power companies were there, people once walked across the rocks above the American Falls." (Testimony of Gen. Greene at hearing on H. R. 26,688 — 1911, page 549.) The ordinary minimum flow of the river is about 180,000 cubic feet per second and at rare intervals it is even less.

General Statement Regarding Power Developments.— The first development at this point was commenced in 1857 when the first canal of what is now the Niagara Falls Hydraulic Power & Mfg. Co's development was dug. A description of this work occurs later. About the time of the classic first long distance transmission of power from Lauffen to Frankfort there was great activity in securing charters and developing power at Niagara Falls. Within ten years the New York Legislature had granted or enlarged charters for eight different companies to take water from above the falls and discharge it at various points below. Two of them are now actually developing power.

TABLE XV.

STATE OF NEW YORK, CONSERVATION COMMISSION, DIVISION OF INLAND WATERS, AVAILABLE POWER AT NIAGARA RIVER.

Horsepower that can be generated at 75 per cent total efficiency with different flows, and equivalent number of tons of coal required at 6.6 tons per H. P. per year.

TERMINALS	Head	200,000 Cubic Feet Per Second		100,000 Cubic Feet Per Second		56,000 Cubic Feet Per Second		36,000 Cubic Feet Per Second	
		Horsepower	Coal in tons	Horsepower	Coal in tons	Horsepower	Coal in tons	Horsepower	Coal in tons
Buffalo to Lewiston	336	5,724,000	37,780,000	2,862,000	18,890,000	1,603,000	10,580,000	1,030,000	6,798,000
Niagara Falls Hydraulic Power & Manufacturing Co.:									
Mouth of canal to Lewiston	326	5,556,000	36,660,000	2,778,000	18,330,000	1,555,000	10,260,000	1,000,000	6,600,000
Mouth of canal to Devil's Hole	314	5,352,000	35,320,000	2,676,000	17,660,000	1,499,000	9,893,000	964,000	6,362,000
Mouth of canal to pool below falls	218	3,712,000	24,500,000	1,856,000	12,250,000	1,040,000	6,864,000	668,500	4,412,000
Head Utilized	202.4	3,448,000	22,760,000	1,724,000	11,380,000	966,000	6,376,000	621,000	4,100,000
Niagara Falls Power Co.:									
Forebay to Lewiston	326	5,556,000	36,660,000	2,778,000	18,330,000	1,555,000	10,260,000	1,000,000	6,600,000
Forebay to Devil's Hole	314	5,352,000	35,320,000	2,676,000	17,660,000	1,499,000	9,893,000	964,000	6,362,000
Forebay to pool below falls	217	3,698,000	24,400,000	1,849,000	12,200,000	1,036,000	6,838,000	666,000	4,400,000
Head Utilized	138.5	2,360,000	15,576,000	1,180,000	7,788,000	661,000	4,363,000	425,000	2,805,000
Pool above Suspension Bridge to Devil's Hole	82.5	1,406,000	9,280,000	703,000	4,640,000	393,500	2,597,000	253,000	1,670,000

Terminals	Head	20,000 Cubic Feet Per Second		10,000 Cubic Feet Per Second		9,600 Cubic Feet Per Second		8,600 Cubic Feet Per Second	
		Horsepower	Coal in tons	Horsepower	Coal in tons	Horsepower	Coal in tons	Horsepower	Coal in tons
Buffalo to Lewiston	336	572,400	3,778,000	286,200	1,889,000	274,800	1,814,000	246,200	1,625,000
Niagara Falls Hydraulic Power & Manufacturing Co.:									
Mouth of canal to Lewiston	326	555,600	3,666,000	277,800	1,833,000	266,800	1,761,000	239,000	1,577,000
Mouth of canal to Devil's Hole	314	535,200	3,532,000	267,600	1,766,000	257,000	1,696,000	230,200	1,519,000
Mouth of canal to pool below falls	218	371,200	2,450,000	185,600	1,225,000	178,200	1,176,000	159,600	1,053,000
Head Utilized	202.4	344,800	2,276,000	172,400	1,138,000	165,500	1,092,000	148,300	980,000
Niagara Falls Power Co.:									
Forebay to Lewiston	326	555,600	3,666,000	277,800	1,833,000	266,800	1,761,000	239,000	1,577,000
Forebay to Devil's Hole	314	535,200	3,532,000	267,600	1,766,000	257,000	1,696,000	230,200	1,519,000
Forebay to pool below falls	217	369,800	2,440,000	184,900	1,220,000	177,500	1,172,000	159,000	1,049,000
Head Utilized	138.5	236,000	1,557,600	118,000	778,800	113,300	748,000	101,500	669,900
Pool above Suspension Bridge to Devil's Hole	82.5	140,600	928,000	70,300	464,000	67,500	445,500	60,450	399,000

TABLE XV.

Horsepower that can be generated at 75 per cent total efficiency with given flows, and equivalent number of tons of coal required at 6.6 tons per H. P. per year.

TERMINALS	Head	6,500 CUBIC FEET PER SECOND		4,400 CUBIC FEET PER SECOND		Efficiency of use
		Horsepower	Coal in tons	Horsepower	Coal in tons	
Buffalo to Lewiston	336	186,000	1,228,000	125,900	830,900	
Niagara Falls Hydraulic Power & Manufacturing Co.:						
Mouth of canal to Lewiston	326	180,500	1,191,000	122,200	806,500	
Mouth of canal to Devil's Hole	314	174,000	1,148,000	117,800	777,500	
Mouth of canal to pool below falls	218	120,600	796,000	81,750	539,600	100.0% (assumed)
Head Utilized	202.4	112,100	740,000	75,900	500,900	93.0%
Niagara Falls Power Co.:						
Forebay to Lewiston	326	180,500	1,191,000	122,200	806,500	
Forebay to Devil's Hole	314	174,000	1,148,000	117,800	777,500	
Forebay to pool below falls	217	120,200	793,300	81,400	537,200	100.0% (assumed)
Head Utilized	138.5	76,750	506,600	51,950	342,900	63.9%
Pool above Suspension Bridge to Devil's Hole	82.5	45,680	301,500	30,920	204,100	

TABLE XVI.

TABLE SHOWING PRESENT DEVELOPMENTS AND USES OF WATER AT NIAGARA FALLS.

NAME OF COMPANY	Available head feet	Head utilized feet	Diversion 1911	Ultimate diversion	Power H. P. 1911	Ultimate power
Niagara Falls Hydraulic Power & Manufacturing Company	218	210	4,000	*6,500	66,000	124,000
Niagara Falls Power Company	217	1,385	8,600	*8,600	63,000	†85,000
Erie canal tenants	......	225	500	*500	......	10,300
Canadian Niagara Falls Power Co	172	136	4,620	9,500	53,500	110,000
Ontario Power Company	202	178	5,200	12,000	78,000	180,000
Electrical Development Company	197	135	3,640	11,200	40,000	125,000
Niagara Falls Park Ry. Company	......	......	1,500	1,500	......	......
Welland canal tenants	......	......	1,800	1,800	......	......
Total	......	......	29,860	51,600	300,500	634,300

* Permits of Secretary of War.
† Most economical combination of machines.

On the Canadian side there was even greater activity and ten charters were granted.

Table XV shows the power possibilities for various combinations of head and tail race elevations and volumes of water, together with the equivalent amount of coal required to produce the same power in a modern steam plant of the highest type.

The total installation for which provision has been made by permits to use water at Niagara Falls is now 620,000 H. P. Of this amount about 415,000 H. P. are on the Canadian side and 205,000 on the American side.

Governmental Control of Diversions.— In 1883 the Legislature passed an act providing for the purchase of lands at Niagara Falls for a park, and in 1885 another act declaring that the park should be used for the purpose of restoring the scenery at the falls, and should be free to all. Five commissioners were appointed and $25,000 per year appropriated for care and maintenance.

The International Water-Ways Commission was created in 1902. On March 16, 1906, the Congress requested from this Commission a report on "what action is in their judgment necessary and desirable to prevent the further depletion of water flowing over Niagara Falls" and directed them to use "all possible

efforts for the preservation of the said Niagara Falls in their natural condition."

On March 19th the Commission made a report and specific recommendations. Appendix B gives in full the most important portion of the report.

In brief, the Commission reported that the diversion for power at the falls was then 17,800 cubic feet per second, which amount had appreciably affected the falls, and that the diversions authorized by New York State and the Canadian Government for the utilization of which work had already started, totaled 60,900 — 34,200 on the Canadian side and 26,700 on the American side. The Commission then recommended that the Secretary of War be authorized to issue permits totaling 20,000 second feet to American companies for two years, the law then to become permanent if in the meantime the Canadian Government had provided for a restriction to 36,000 cubic feet per second on their side.

These recommendations were adopted with some modifications by Congress in the Burton Law passed the same year. This law provided for the issue of permits for diversion to the extent of the water then actually in use or contracted for, the total of which should not exceed 15,600 second feet. When this amount had been in use six months, *revocable* permits for a further diversion subject to the limitation that such additional diversion "in connection with the amount diverted on the Canadian side shall not injure or interfere with the navigable capacity of said river or its integrity and proper volume as a boundary stream, or the scenic grandeur of Niagara Falls." The importation from Canada was limited to 160,000 H. P., but further permits could be issued provided the total generated on the Canadian side was not in excess of 350,000 H. P. The President was also requested to negotiate a treaty with Great Britain to effectually preserve the scenic grandeur of the falls. Such a treaty was negotiated and proclaimed on May 13, 1910. It is given in full in Appendix C. Under the treaty the diversions for power at the falls were to be restricted to 20,000 cubic feet per second on the American side and 36,000 cubic feet per second on the Canadian side.

The Burton Law was to expire on June 29, 1909, but before its expiration it was extended two years and again extended in 1911.

Under the Burton Law the Secretary of War has issued permits for diversions as follows:

	Cu. ft. per sec.
Niagara Falls Power Co.	8,600
Niagara Falls Hydraulic Power & Mfg. Co.	6,500
Erie canal for power at Lockport, etc.	500
Total	15,600

Table XVI shows the companies diverting water on both sides, present diversion, ultimate diversion as fixed by treaty, permit or contract, etc.

Effect of Diversion Upon Navigation and Scenery.— Although the river has a total surface slope of eleven feet from Buffalo to the intakes of the two American companies, the army engineers have shown that these diversions by affecting the back water curve affect the water level of Lake Erie. They have determined that a continuous diversion of 15,100 cu. ft. per second from the pool above the rapids above the falls will lower Lake Erie by a little less than an inch. This can, however, be readily compensated for by the building of wing dams if such a course should be found necessary.

The effect of diversion upon the falls as a spectacle is far more serious. The pressure of population upon subsistence may possibly ultimately require the use of all the power. Various expedients are, however, possible whereby the benefits of the spectacle can be derived with but little sacrifice of the practical use. The various stages of the evolution to complete utilization heretofore suggested may be summarized:

First. The construction of a weir above or in the rapids whereby the sheet of water will be more evenly spread over the entire crest line of the Falls. The extraction of a large portion of the water from the Horseshoe Falls would not lessen the spectacular effect and such a distributing weir would permit of

greater diversions without interference with scenic effects, and at the same time the destructive effects of the concentration of water at the apex of the Horseshoe would be greatly lessened and the recession of the falls retarded.

Second. The construction of regulating works at the outlet of Lake Erie whereby excessively high and low flows can be prevented and surplus used for power.

Third. The use of such works to completely shut off the night flows from the falls and the use of the water thus stored during the night for generating power when required, and

Fourth. The utilization of the entire flow of the river for power except for its occasional use for a spectacle on specified days.

Of course, the fourth expedient will not be adopted until the far distant future.

Niagara Falls Hydraulic Power and Development Co.— The original development on the site now occupied by this company was begun in 1857 by the predecessor of the present company which obtained its rights from Augustus Day. The canal then constructed was 36 feet wide, 8 feet deep and 4,400 feet long, extending from Port Day about one mile above the falls to a point below the falls. The present company was organized in 1877 under general laws and purchased the existing canal and rights. An enlargement of the canal to 70 feet width by 10 feet depth was then projected.

In 1895 a second enlargement was in progress when the right of the company to divert any water was questioned. As previously noted, New York State had become the lower shore owner a short time before and the right of the company to divert waters as against a lower shore owner was attacked. To meet this condition the Legislature passed an act (chapter 968, Laws of 1896) recognizing and confirming the right of the company to use the water of Niagara river, but the use "is hereby limited and restricted to such quantity of water as can be drawn by means of the hydraulic canal of said company when enlarged throughout its entire length to a width of 100 feet and to a depth and slope sufficient to carry at all times a maximum uniform depth of fourteen feet of water * * *." This obviously fixes no limit to the volume of water that may be taken by the company. The en-

largement then in progress has apparently never been completed, as the company continues to enlarge and deepen. Work was in progress in 1909 and it is understood further enlargements are contemplated.

The maximum diversions of this company in 1910 were 4,000 cubic feet per second, for which they obtained 66,000 electrical horsepower, as shown by Table XVI. The company makes use of a greater proportion of the available head than any other company using Niagara water.

Niagara Falls Power Company.— This company did most of the pioneer work in long distance transmission and large capacity high head development in America. The company was chartered for fifty years in 1886 as the Niagara River Hydraulic Tunnel, Power and Sewer Company of Niagara Falls. (Chapters 83 and 489, Laws of 1886.) The name was subsequently changed to its present name and the charter amended several times. (Chapter 109, Laws of 1889; chapter 253, Laws of 1891; chapter 513, Laws of 1892; chapter 477, Laws of 1893.) It is authorized to take the water of Niagara river limited in amount to not " more water than shall be sufficient to produce 200,000 effective horsepower."

Water is taken from Niagara river in a short canal (1,200 feet long). On each side are excavated the wheel-pits of two power houses. The turbines are located at the bottom of the wheel-pits, and the tail water is carried off by a tunnel having an area of 320 square feet. The tunnel was designed to carry 8,000 cubic feet per second, requiring a velocity of 25 feet per second. This excessive velocity is exceedingly wasteful of the potential energy of the water. At the time it was built this was not considered so important as now, however, and other features of the design reduce the head from 217 feet total available to 136 feet used in power house No. 1 and 140 feet in power house No. 2. In power house No. 1 there are 10 units of 5,000 H. P. each, and in power house No. 2, 11 units of 5,500 H. P. each, or a total installation of 110,500 H. P. In addition the company leases hydraulic power to the International Paper Company which uses about 700 cubic feet per second. With an economical use of the water, 11,000 cubic feet per second would be required to develop 200,000

effective horsepower. The maximum power that can be produced with the present tunnel is 93,000 H. P. with 10,360 cubic feet per second of water.

Canadian Developments.— The Canadian Government, profiting by the experience on the American side, has been able to handle the situation at Niagara much better than have our governments. A park was established on the Canadian side shortly after the establishment of that on the American side. The Queen Victoria Niagara Falls Park extends nearly from Lake Ontario to Lake Erie, embraces 734 acres of land and is a half mile wide at the falls. It is in charge of a commission which has authority to make contracts for the development and transmission of power within the park, but the contracts do not become operative until approved by the Legislative Assembly. In the present situation, the Canadians appear to be proceeding strictly in accordance with the report of the International Waterways Commission, distributing the 36,000 cubic feet per second allowable under the treaty in accordance with that report (see Appendix B). This will allow an ultimate development of about 450,000 H. P. (Table XV), for which the government will receive an income of nearly $300,000 per year.

Recommendations.— As regards the legal and economic situation at Niagara, it is believed that the charters of the corporations to whom privileges have been granted by the State may be amended so as to require —

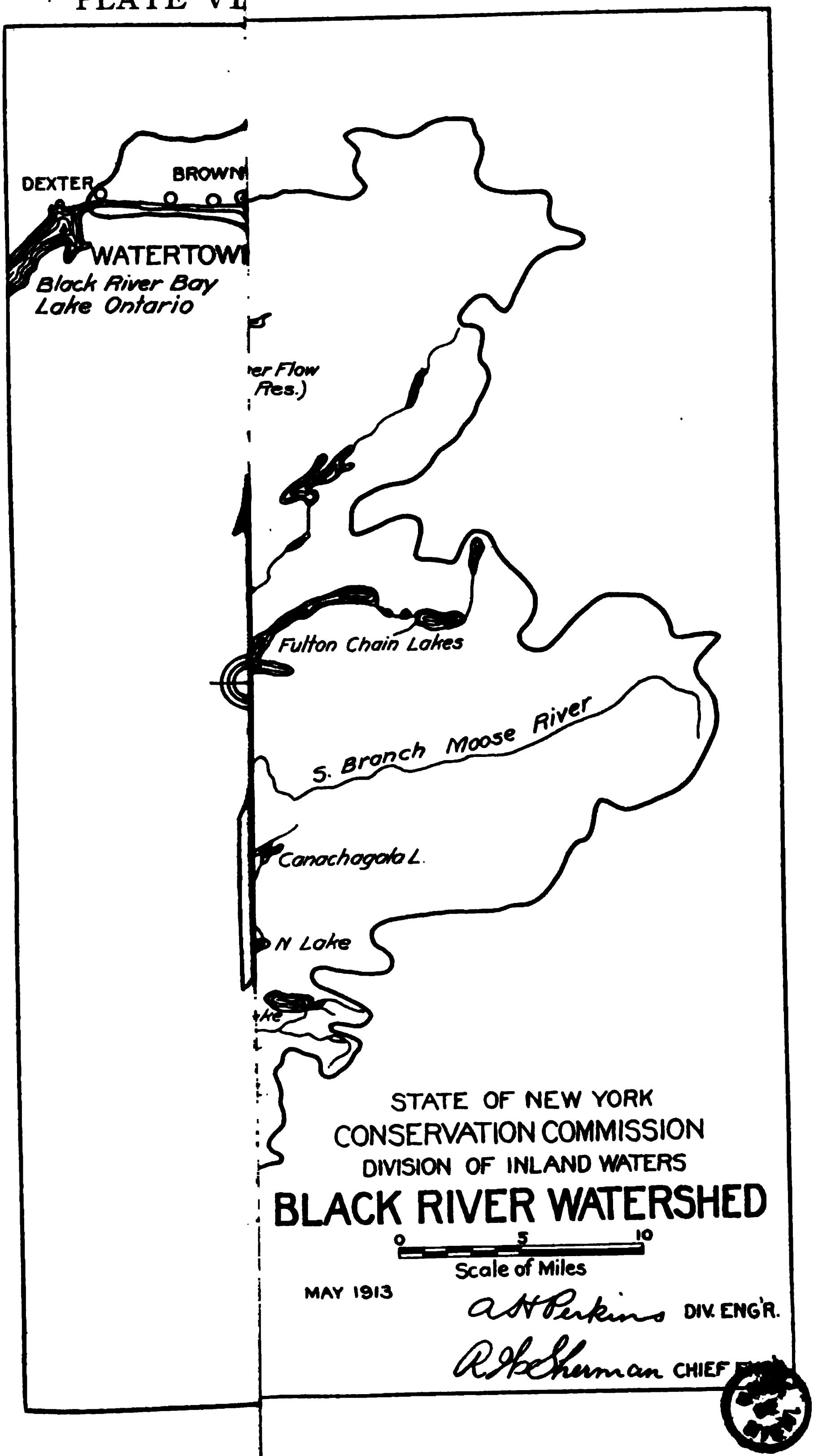
1. Full economic use of water granted.
2. Diligent prosecution of full development.
3. Complete definition of rights granted.

To this end it is recommended that laws be passed as follows:

1. Limiting the charter of the Niagara Falls power company to 8,600 second feet.

2. Specifying in cubic feet per second the amount of water (not to exceed 6,500 second feet) that may be taken by the Niagara Falls Hydraulic Power & Manufacturing Company. Probably 5,000 second feet is more than it was originally intended to grant.

PLATE VI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CONSERVATION COMMISSION
DIVISION OF INLAND WATERS
BLACK RIVER WATERSHED
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MAY 1913
A H Perkins DIV. ENG'R.
R H Sherman CHIEF

3. Amending the charters of all other companies that have not expired by limitation so that proposed works must be completed within a given time or the charter expire by limitation.

REPORT ON DIVERSIONS FROM THE BLACK RIVER WATERSHED.

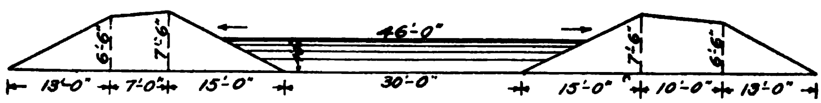
Water power owners on the Black river frequently make the claim that they have never been fully compensated in kind or in cash for the diversions made by the State through the Black river feeder to the Erie canal.

The engineering force has made a study of the history of this feeder and the various reservoirs, the money awards to riparian owners and the stream flow records.

HISTORY.

The law authorizing the construction of the Black River canal and Erie canal feeder, which was passed on April 19, 1836, indicated in its phrasing the real argument for its passage, inasmuch as it was specifically stated that the construction should be such as to pass as large a quantity of water to the Erie canal as could reasonably be spared from the Black river and the northerly portion of the Black River canal. In accordance with this act a diversion dam was built on the Black river at Forestport (then known as Williamsville) from which a feeder ten miles in length extended to the summit level of the Black river canal proper at Boonville. This feeder was designed, according to various State Engineers' reports, to carry from 14,000 to 16,000 cubic feet per minute, in the following section:

SECTION OF BLACK RIVER CANAL FEEDER.



DESCENT SEVEN INCHES PER MILE.

This dam was completed in 1848, and water was turned into the feeder that year for the purpose of testing the banks. The actual diversion first took place in 1849. This first year in the history of the feeder proved to be the driest year in the memory of the inhabitants for a period of thirty years back. This statement is made by Mr. D. C. Jenne in his report to the Canal Commissioners in regard to the advisability of building storage reservoirs. (Senate Document No. 102. See also abstract of history attached hereto, page 3.) Mr. Jenne is also authority for the statements " that the measurements made in connection with the work (i. e., constructing the feeder) showed the volume of water in the Black river at the point where it is diverted to be 14,000 to 16,000 cubic feet per minute at its minimum flow; that the amount of water in the Black river at Forestport, at its lowest stage, during the summer of 1849, was only about 9,000 cubic feet per minute, and that nearly the whole volume of water was diverted for about three months that year." This left the river nearly dry as far as Lyons Falls, and reduced the flow from 30 per cent to 40 per cent below the falls. (It will be noted that the drainage area ratio of the Black river at Forestport to that at Lyons Falls is about .305.) It may be said that Mr. Frothingham, resident engineer, in 1842 measured the low water flow at Forestport as 11,500 cubic feet per minute. Mr. Jenne points out the fact that if storage reservoirs were not constructed that incalculable damage would be done to the power owners on the Black.

A temporary dam 5 feet high was constructed at Woodhull lake in the fall of 1849, and was closed the 9th of November.

Based upon this report of Mr. Jenne, the Legislature in 1851 passed chapter 181, which authorized the Canal Commissioners to examine and cause to be built such reservoirs on the head waters of the Black, Moose and Beaver rivers as they thought necessary, so that the " waters thus reserved shall be let into the Black river during the summer months in such manner and in such quantity as to give, so far as practicable, to the inhabitants residing on said river the benefit of said reserved waters when the same shall be required for use, and such supply shall not be less than the quantity which ordinarily flows in said river during the summer, provided the supply from said reservoirs will furnish

such quantity after supplying the Black River canal and the Erie Canal with water."

Before discussing the question of the claims which were presented, it might be well to state when the reservoirs provided for in this act, and what ones, were built and brought into use. It will be seen that the awarding of the claims was held up by the appraisers pending the completion or the assurance of the completion of the said reservoirs.

TABLE XVII.

RESERVOIR	Completed	Brought into use	Capacity of reservoir	Amount of water available according to reports of 1860–63
			Cu. ft.	*Cu. ft.*
North Branch Black River....	Oct. 1, 1856	1857	310,000,000	620,000,000
Woodhull..................	1859	1860	780,943,680	780,940,000
South Branch Black River.....	1860	1861	421,190,000	421,190,000
Total in 1861...........	....	....	....	1,822,130,000

It was computed that these reservoirs on this basis would furnish 11,000 cubic feet per minute for 110 days, and the Commissioners, therefore, determined that the construction of the Chub Lake reservoir which had been originally planned was unwarranted, inasmuch as the law had been complied with. Later developments, however, show the error of these computations. These errors were as follows: In the first place, 16,000 cubic feet per minute was being diverted at Forestport, of which approximately 11,000 cubic feet per minute went to supply the Erie canal, the remaining 5,000 cubic feet per minute being returned to the Black river at Lyons Falls. The canal authorities apparently computed that 11,000 cubic feet per minute would be the draft from the reservoir instead of 16,000 cubic feet per minute, with the result that the reservoirs were depleted before the computed time. Assuming a capacity of 1,822,000,000 cubic feet as above, and 16,000 cubic feet per minute discharge, the supply would last only 79 days. Moreover, Woodhull lake required two years to fill, due to the small tributary drainage area, and it is doubtful whether North lake reservoir was ever emptied to advantage twice yearly, that is at the time the water was required.

On this basis we would have the following as the available capacity per year instead of 1,822,000,000 cubic feet:

North Branch	620,000,000
Woodhull	390,000,000
South Branch	421,100,000
	1,431,690,000

This will furnish 16,000 cubic feet per minute for 62 days.

To go back to the time of the first diversion in 1849, and follow up the history of the claims for damages: Following the diversion, claims were presented for damage by some power owners and apparently some claims were settled in favor of those whose property was above Lyons Falls. (According to the report of Mr. Kibbe — State Engineer's Report 1888, page 279.) These claims were settled by the Canal Commissioners and paid by the auditor on the basis that the damage was of a temporary character. The fact that the building of reservoirs had been a matter of discussion, although not an assured fact until chapter 181 of the Laws of 1851, above referred to, was passed, is probably the reason that some claims were not presented although certain owners suffered damage, and those which were presented were settled on the basis of temporary damage. The canal appraisers in their award in the case of Platt Williams (Senate Document No. 100, 1859) stated that they inferred "from the language of the act of 1836 that it was thought sufficient water for the supply of the canal could be taken without interfering with the various water powers along the banks"; but that the measurements above referred to showed that "in a dry time the canal would require nearly all the water in the river" (at Forestport). It was then first proposed to construct reservoirs and, as had been shown, these were not authorized until two years after the first diversion, and were not completed until many years after that. The appraisers go on to say in this award that "these reservoirs were evidently in contemplation by the Canal Commissioner and the engineers in charge," and hence the Canal Commissioner seems to have conceived the idea of appropriating the water of the Black river temporarily, and of paying damages to the occupants of water

powers from year to year on the basis of a temporary appropriation until the reservoirs were constructed and water restored equal to the amount taken out.

This system of adjusting claims for temporary damage was carried on until, on April 14, 1854, a draft issued to John Post by the Canal Commissioner was protested by Marius Schoonmaker, auditor of the Canal Department, on the ground that it was issued without authority of law. The auditor held that the damage was of a permanent character, that the law of 1836 intended that the diversion should be permanent, and that the construction of diversion works of a permanent nature was proof in itself of the intent of the law. This case was carried up to the Court of Appeals, which tribunal sustained the auditor. (See 3 Kernan 238).

By the statute of limitations, claimants for damage sustained by the diversion, which was effected in 1849, were prohibited from presenting their claims at the time this decision was rendered, and the Legislature came to their rescue and passed, on April 3d, chapter 247 of the Laws of 1857, which provided that "within one year from the passage of this act it shall be lawful for the owners and lessees of land and water rights upon the Black river to present their claims for damages, on account of the taking of the waters of the said river for the use of the Black river canal and the Erie canal feeder, the same as if they had been presented within the time prescribed by law."

Accordingly, some sixty-two claims, amounting in the aggregate to over $600,000 were presented. These were disposed of as shown in the tabular list attached. Two leading cases were written up by the appraisers (Platt Williams v. The State, and the Black River Woolen Co. v. The State). The case of Platt Williams being more particularly applicable to the claims at Carthage and above, where the question of the benefits to be derived from the construction of the Black River canal was an element to be considered in the opinion of the appraisers, while the status of those claimants below Carthage was presented in the award of the Black River Woolen Co. of Watertown. The records of the testimony in these claims were destroyed in the Capitol fire in

1911. Senate Document No. 100, 1859, contains the portion of these two awards which has a general bearing upon the subject.

Upon the subject of the flow, the appraisers state — that the feeder was designed for 16,000 cubic feet per minute, but that it seemed that 14,000 cubic feet per minute was all that could be passed with safety to its banks; that the entire flow of the river at Forestport in a dry time does not much exceed 13,000 or 14,000 cubic feet per minute; that in 1849 it was only 9,000 cubic feet per minute; that of the quantity taken in at the feeder, it is estimated that about 2,000 or 3,000 cubic feet per minute is returned to the river by leakages, lockages waste weirs, etc., between Boonville and Lyons Falls, the balance flowing southward to feed the Erie canal; that the entire flow of the river at Carthage, even in dry time, in view of the above data, cannot be less than 40,000 cubic feet per minute.

In the award mention is made of the four reservoirs which the State had decided to build and were in course of construction — namely, the Woodhull, North and South Branch, and Chub Lake.

The appraisers stated when these reservoirs were built there would be 1,899,235,000 cubic feet available, or 16,000 cubic feet per minute for 113 days. (This depended upon filling North Branch twice and the others once.) In view of the uncertainty of the facts as to whether these reservoirs were to be completed or not, the canal appraisers were at a loss to determine the ultimate damage.

In the award of the Black River Woolen Company the canal appraisers state that although the water to the extent of 11,000 cubic feet per minute is taken for seven months of navigation, no injury results to the riparian owners at Watertown and below except in a dry season. From the evidence the opinion of the appraisers was that the average period during which injury arose from the diversion was about 60 days. This, of course, did not specify at just what time the period began each year, but took in the fact that some years there was at all times plenty of water. This is all that is said on the subject of the flow.

The canal appraisers in concluding their award said:

> " With a view to save the necessity of presenting our general views in each case, and also with the view of placing

ourselves plainly on the record, so that errors, if they are made, may be corrected on appeal, we propose to state here certain leading principles that will be recognized and followed, in passing upon this and the other claims in its vicinity. Having done this, we shall attempt to avoid the reiterating of them in the other awards that are to follow.

"1. The State will be held liable for the damages sustained by the riparian owners, in consequence of the diversion, on the principle that fresh water rivers to the middle of the stream belong to the owners of the adjacent banks — that they are entitled to the usufruct of the waters as appurtenant to the fee — and for an interruption in the enjoyment of their privileges in that respect, in consequence of public improvements made by the State, are entitled to compensation for damages sustained. The Commissioners of the Canal Fund v. Kempshall, 26 Wend. 404.

"2. There can be no allowance only to those who owned in 1849, or to the assignees of their claims.

"3. Nor can any allowance be made, even to the owners of 1849, for any special damages from year to year since, except by way of interest on the sum that shall be determined as the real loss when the injury accrued.

"4. The State cannot be held to pay for mills or other structures erected, or investments made since that year, when everybody knew that the waters had been diverted. These erections or investments were at the risk of those who made them.

"5. Nor can we take into consideration remote and contingent damages to property separate and distinct from water power and the property upon it, alleged to have been depreciated in value by the diversion.

"6. In estimating damages to a particular water power, additional expenses incurred in putting in new wheels, machinery, etc., adapted to the new state of things, will be considered, but only as bearing upon the extent of the damages of 1849, which required such expenditures to restore the power.

"7. While we cannot wholly ignore the fact that the State

has had in contemplation the erection of the reservoirs, and may yet complete them, and the water be restored, we can only take these things into account in a qualified and limited sense.

" 8. An appraisal will be fixed on the injury to the property at its value in 1849, and nine years' interest allowed thereon."

These claims were appealed as noted in the attached table, with the decisions of the Canal Board attached thereto. The awards below Lyons Falls were reduced 35 per cent., it being stated that no regard had been taken in the original award of the benefit to be received from storage.

Historically, this brings us down to the time of the completion of the South Branch reservoir in 1861. Taking up the history of these reservoirs from that point we find that on account of the fact that the canal authorities had computed that the Woodhull, North and South Branch reservoirs were of sufficient capacity no further construction was undertaken until 1872. In this year the Sand Lake reservoir was built, and brought into use in 1873.

Table XIX has been prepared, showing what information appears in the reports of the State Engineer and Surveyor from 1860 to date in regard to the various reservoirs. Outside of these tabulations of capacity, etc., there appear from time to time various comments which will be noted.

In 1862 Mr. Jenne made recommendations as to the advisability of keeping records of water levels and gate openings at these reservoirs, and in a later report stated that his recommendations had been complied with. (See letter of May 20th from Chief Engineer to Superintendent of Public Works asking for said records.)

Hon W. B. Taylor, State Engineer and Surveyor, in his report for 1873 stated that the water power owners had never been compensated on account of the failure of the reservoirs to furnish sufficient water, and also owing to the fact that the awards of the appraisers were made on the basis that the reservoirs would supply all the water necessary. He goes on to say that legally they had no claim for additional damages, but that the State was honor bound to return the water to them.

Mr. William V. Van Rensselaer, Assistant Superintendent of Public Works in 1881, reported that an investigation made by him in May showed that at Sand Lake the gate house had been broken into and the water used to float logs.

In 1888 Mr. Kibbe, who had been assigned by State Engineer, Hon. John Bogart, to report upon the resolution of the Senate on the diversion of the waters of the Black river made a lengthy report upon the subject. This report appears in the State Engineer's report for 1888, page 277.

In 1898 Mr. David E. Whitford made a report on the "Water supply from the Adirondack forest" which was published in the report of the State Engineer and Surveyor for that year. This report is quite exhaustive as to bibliography.

In 1901 Mr. Emil Kuichling made a report to the State Engineer and Surveyor on the water supply for the proposed Barge canal, and in this report gives a table of reservoir capacities available on the Upper Black. This table, as well as the one made by Mr. Whitford, is shown in the general table attached. Mr. Kuichling's report also contained the following measurements made near Boonville in the canal and feeder.

Date	Flow in Feeder cubic feet per second.	Flow in Canal South cubic feet per second.	Flow in Canal North cubic feet per second.
August 31, 1900	254.35	197.37	61.72
September 24, 1900	310.57	242.18	70.15
November 7, 1900	323.06	254.23	68.83
December 1, 1900	253.23	181.20	69.03

The Moose and Beaver river reservoirs were built in 1882 and 1886–87, and have a storage capacity of about 900,000,000 cubic feet and 800,000,000 cubic feet respectively.

TABLE XVIII.

SHOWING CLAIMS PRESENTED, THE AMOUNT AWARDED, AND FINAL AWARD — INFORMATION FROM SENATE DOCUMENTS — 1859, No. 100; 1860, No. 44; 1861, No. 30.

COMPANY	Address	Location of plant	Claim filed	Amount claimed	Amount allowed	When decided	When appealed	By whom appealed	Final award (took off 35 per cent)
Hurd, L. D. & H. H.	Dexter		11/ 7/56	$20,000		12/31/58	9/14/59	Claimant	
Jefferson Mfg. Co.	Dexter		11/ 7/56	10,000	$8,965	12/31/58	9/12/59	Comm.	$5,827.25
Magee, Thomas, and others	Dexter		11/ 7/56	50,000		12/31/58	9/14/59	Claimant	
Andrews, Cornelia S., et al	Brownsville			20,000	6,520	12/31/58	9/12/59	Comm.	4,238.00
Codman & Frisbee	Brownsville		11/ 7/56	4,875	815	12/31/58	9/12/59	Comm.	529.75
Brown, John E.	Brownsville		11/ 7/56	10,000	1,630	12/31/58	9/12/59	Comm.	1,059.50
Lord, Wm.	Brownsville		11/ 7/56	21,039	3,260	12/31/58	9/12/59	Comm.	2,119.00
Loomis, C. K.	Brownsville		11/ 7/56	9,300	978	12/31/58	9/12/59	Comm.	635.70
Skinner, Alanson	Brownsville		11/ 7/56	10,000	2,934	12/31/58	9/12/59	Comm.	1,907.10
Wheelock, Chas.	Brownsville		11/ 7/56	2,000		12/31/58	9/14/59	Claimant	
Williams, Platt	Brownsville		8/12/56	23,000	3,500	12/31/58			
Wheelock, Wm. & Co.	Brownsville		11/ 7/56	2,000	815	12/31/58			
Wilcox, Asel	Brownsville		9/29/55	2,500		12/31/58	9/14/59	Claimant	
Antwerp Lumber Co.	Watertown		11/ 7/56	1,000		12/31/58			
Anderson, Andrew	Watertown		8/20/57	4,000		12/31/58			
Baker, Thomas	Watertown		11/ 7/56	5,000	2,445	12/31/58	9/12/59	Comm.	1,589.25
Black River Woolen Co.	Watertown		11/ 7/56	7,000	7,000	12/31/58	9/12/59	Comm.	4,550.00
Brown & Chamberlain	Watertown		11/10/56	10,000		12/31/58	9/14/59	Claimant	
Case, C. C.	Watertown		11/ 7/56	5,000		12/31/58			
Dexter, D. & E. A.	Watertown		11/10/56	1,200		12/31/58	9/14/59	Claimant	
Dexter, D. & E.	Watertown		11/ 7/56	5,000		12/31/58	9/14/59	Claimant	
Dexter, Martin & Holcomb	Watertown		11/ 7/56	10,000	2,445	12/31/58	9/12/59	Comm.	1,589.25
Dougherty, Patrick	Watertown		11/ 7/56	5,000	2,445	12/31/58	9/12/59	Comm.	1,589.25
Farwell, Eli & Co.	Watertown		7/26/58	7,500	4,890	12/31/58	9/12/59	Comm.	3,178.50
Holcomb, Hiram	Watertown		11/ 7/56	5,000	326	12/31/58	9/12/59	Comm.	211.90
Knowlton, C. W., Watertown Bank & Loan, et al.	Watertown		11/10/56	41,000	8,150	12/31/58	9/12/59	Comm.	5,297.50
Knowlton, C. W., & Clark Rice	Watertown		11/ 7/56	47,000	19,560	12/31/58	9/12/59	Comm.	12,714.00
Kimball, Presendia, Administratrix, etc.	Watertown		11/ 7/56	5,974.38	2,445	12/31/58	9/12/59	Comm.	1,589.25
King, Amos	Watertown		11/ 7/56	3,000		12/31/58			
Kimball, V. P.	Watertown		11/ 7/56	4,000	1,956	12/31/58	9/12/59	Comm.	1,271.40
Mundy, Pierson, Assignee, etc.	Watertown		11/ 7/56	20,000	4,890	12/31/58	9/12/59	Comm.	3,178.50
Mack, S. D. & J. C.	Watertown		11/ 7/56	10,000		12/31/58	9/14/59	Claimant	
Miser, J., Jr. & Nathan	Watertown		11/ 7/56	4,000	978	12/31/58	9/12/59	Comm.	635.70
Pool, Sylvanus	Watertown		11/ 7/56	3,000		12/31/58	9/14/59	Claimant	

Pease, A., & N. B. Fisher	Watertown		11/10/56	2,300		12/31/58	9/14/59	Claimant	
Stevens, H. B	Watertown		4/ 2/58	3,000	2,445	12/31/58	9/12/59	Comm	Dismissed
Wait, Ezra	Watertown		11/ 7/56	2,000	326	12/31/58	9/12/59	Comm	211.90
Watertown Woolen Co	Watertown		11/ 7/56	30,000		12/31/58	9/14/59	Claimant	
Watertown Cotton Co	Watertown		11/ 7/56	20,000	6,520	12/31/58	9/12/59	Comm	4,238.00
Wiley, Nathaniel	Watertown		11/ 7/56	2,570	1,630	12/31/58	9/12/59	Comm	1,059.50
Mott, S. E	Black River		11/ 7/56	2,000		12/31/58	9/14/59	Claimant	
Augsbury, J. A	Black River		11/ 7/56	2,000		12/31/58	9/14/59	Claimant	
Stark, A. D	Black River		11/13/56	2,000		12/31/58	9/14/59	Claimant	
Horton, Albert	Rutland	Black River	11/ 7/56	1,500		12/31/58	9/14/59	Claimant	
Rice, S. E	Carthage		11/ 7/56	5,000		12/31/58	9/14/59	Claimant	
Rice, Hiram A	Carthage		11/ 7/56	3,000		12/31/58	9/14/59	Claimant	
Tuttle, Noyes	Carthage		11/ 7/56	2,000		12/31/58	9/14/59	Claimant	
Woolson, R. O	Carthage		11/ 7/56	1,000		12/31/58	9/14/59	Claimant	
Blake, Anson	New York		3/25/58	15,250		12/31/58	7/22/59	Claimant	
Dewey, Cadwell	Leyden		11/ 7/56	13,000		12/31/58	9/14/59	Claimant	
Fenner, Rosell	Boonville		11/ 7/58	5,000		12/31/58	8/ 5/59	Claimant	
Hulbert, J. B	Leyden		7/ 7/58	25,000		12/31/58	9/14/59	Claimant	
Herrick, A. H	Leroy		11/ 7/56	2,700		12/31/58	9/14/59	Claimant	
Howe, Isaac & Joseph	Leroy		11/ 7/56	1,800		12/31/58	9/14/59	Claimant	
Hough, A. E. & H. J	Remsen	Forestport	11/10/56	5,000	655.89	12/31/58			655.89
Hough, Alfred N	Remsen	Forestport	10/25/56	3,000	1,008.14	12/31/58			1,008.14
Hawkins, Sterry & Wm. H. Cole	Hawkinsville		5/11/56	1,164.27	1,164.27	12/31/58			1,164.27
Lyon, L. R	Lyons Falls		8/30/55	13,800		12/31/58	9/ 7/59	Claimant	
Mundy, Wm. D. (Murry W. D.)	Boonville	Hawkinsville	11/ 7/56	3,000		12/31/58	9/14/59	Claimant	
Reeger, H. D., & D. Waterman, assignee	Hawkinsville		3/11/56	22,000	3,968.25	12/31/58			3,968.25
Snyder, H. D. H	Leyden		7/ 7/58	13,000		12/31/58	9/14/59	Claimant	
Merrian, E. & Co	Leyden		11/ 7/56	4,000		12/31/58	9/14/59	Claimant	
				$594,472.65	$104,684.55				$66,016.75

TABLE XIX.

A TABULAR REPRESENTATION OF THE GENERAL INFORMATION CONCERNING CAPACITY, ETC., OF THE VARIOUS RESERVOIRS AS CONTAINED IN THE REPORTS OF THE STATE ENGINEER AND SURVEYOR, 1860–1910.

RESERVOIR	Drainage area	When completed	When brought into use	Surface area	Average area	Depth	Capacity	Remarks	State engineer's report date
	Sq. miles	*Year*		*Acres*	*Acres*	*Feet*	*cubic feet*		
North Branch				423	277	28	310,000,000		1862–1876
North Branch								Will supply 2,346 c. f. m. (prob. 100 days)	1877–1880
North Branch							337,851,360		1881–1896
North Branch		1856	1857		277	25	301,653,000		1898 (Whitford)
North Branch					277	26	301,653,000		1899
North Branch	31.4					10	120,661,200		1901 (Kuichling)
Woodhull				1,236	1,118	18	876,550,000	Says will require 2 yrs. to fill (1880 Rep.)	1862–1876
Woodhull								Will supply 6,087 c. f. m.	1877–1880
Woodhull							876,601,440		1881–1900
Woodhull		1859	1860	1,236	1,118	18	876,601,440		1898 (Whitford)
Woodhull	9.17			1,236	1,118	10	487,000 800		1901 (Kuichling)
South Branch				518	372	26	421,190,000		1862–1876
South Branch								Will supply 2,926 c. f. m.	1877–1880
South Branch							421,312,320		1881–1896
South Branch		1860	1861	518	372	26	421,312,320		1898 (Whitford)
South Branch				518	372	27			1899
South Branch	6.78				372	10	162,043,000		1901 (Kuichling)
Sand Lake					306		199,880,000		1873–1876
Sand Lake								Will supply 1,388 c. f. s.	1877–1880
Sand Lake						15	199,940,000		1881–1883
Sand Lake		1872	1873	344	306	18	239,928,480		1898 (Whitford)
Sand Lake					306	15			1899
Sand Lake	1.81			344		10	133,293,600		1901 (Kuichling)
Canachagala Lake					320	4	55,756,800	(Approximate capacity)	1881–1897
Canachagala Lake			1881	347	320	10	139,392,000		1898 (Whitford)
Canachagala Lake					320	6			1899
Canachagala Lake	4.25			347	320	4	55,756,800		1901 (Kuichling)
Twin Lakes					175	8	60,984,000	(Approximate capacity)	1881–1897
Twin Lakes			1881	213	175	9	68,607,000		1898 (Whitford)
Twin Lakes					175	8			1899
Forestport Reservoir			1894	793	700	7	213,444,000		1898 (Whitford)
Forestport Reservoir	(total) 147			793	700	7	213,444,000		1901 (Kuichling)
Forestport Pond			1849	160	150	2	13,068,000		1898 (Whitford)

Forestport Pond........	(total) 267	....	....	160	150	2	13,068,000	....	1901 (Kuichling)
Chub Lake............	....	....	1882.....	....	200	4	34,848,000	(Approximate capacity)....	1882–1896
Chub Lake............	7.26	....	....	530	200	4	34,848,000	....	1901 (Kuichling)
Bisby Lakes...........	....	....	....	....	....	3-1/2	40,000,000	(Ap. capac.—Ord. Aband. 1889, Chapter 274)......	1881–1899
Bisby Lakes...........	6.0	....	1881.....	....	2,755	3-1/2	....	....	1899
White Lake...........	....	....	....	....	296	5	60,847,875	(Approximate capacity)....	1881–1882
White Lake...........	....	....	....	....	296	5	64,468,000	(Ordered abandoned 1889, Chapter 274)...........	1883–1899

In considering the question of whether or not the Black River water powers have been sufficiently compensated for the water diverted to the Erie canal, the water powers may be conveniently put into three divisions:

1. Water power plants located on the Black river below the junction of the Beaver and Black rivers (water powers from Carthage to Watertown).

2. Water power plants located on the Black river between the junction of Beaver river and the entrance of the Black river canal (Lyons Falls power plants).

3. Water power plants above the entrance of the Black River feeder (Port Leyden and Boonville plants).

The following are the diversion storage reservoirs with their capacities:

Reservoir	Cu. Ft. Capacity	Cu. Ft. Available Capacity
North lake	*301,600,000	603,200,000
South lake	†421,300,000	210,200,000
Canachagala	†139,400,000	69,700,000
Twin lakes	68,600,000	68,600,000
Forestport reservoir	213,400,000	213,400,000
Woodhull	†876,600,000	438,300,000
Sand lake	†239,900,000	120,000,000
Forestport pond	13,100,000	13,100,000
Total	2,273,900,000	1,737,000,000

Compensating storage reservoirs furnishing water to Black River Water Powers:

Reservoir	Cu. Ft. Capacity	Cu. Ft. Available Capacity
Fulton Chain, 1st to 5th lakes	500,000,000	500,000,000
Fulton Chain 6th and 7th lakes	900,000,000	900,000,000
Beaver river	900,000,000	900,000,000
	1,700,000,000	1,700,000,000

* Can be filled twice a year.
† Can be filled once every two years.

From an inspection of the above table it is seen that although the compensating reservoirs are only supposed to be of sufficient capacity to maintain the average summer flow, yet they are of practically the same capacity as the diversion reservoirs.

The drainage areas of the watersheds of all the above reservoirs are:

	Sq. Mi.
Black river at Forestport (Includes all the diversion reservoirs)	268
Beaver river at Stillwater	165
Moose river at Old Forge	53
	486

The average flow in the Black river canal south is 210 cubic feet per second. As this is the average of all the individual measurements, and not of continuous gagings, it is liable to considerable error. The total water diverted from the reservoir on the average is 250 cubic feet per second, the additional 40 c. f. s. being excess evaporation, percolation and absorption. The average flow returned to the Black river from the Black river canal north is about 65 cubic feet per second.

One way of looking at this problem is this: The matter at hand is to find out whether or not the summer flow (low water flow) of the Black river is as great as it would be were there no storage reservoirs either diverting or compensating on the watershed. To do this we have placed the stream flow records of the Oswegatchie river at Ogdensburg on the same basis as those of the Black river at Felts Mills.

The drainage area of the Oswegatchie river at Ogdensburg is 1,580 sq. mi. and the Black river at Felts Mills 1,851 sq. mi.; also there is a large storage reservoir on the Oswegatchie river — Cranberry lake reservoir (2,100,000 cu. ft.). Hence, if we place the stream flow records of these two stations on a basis of flow per square mile of drainage area and increase the Oswegatchie river flows (which are benefited by storage) in proportion to the average rainfall of these two watersheds, we should be able to judge whether the Black river summer flows (low water flows) are

greater that the reduced natural flow would be of a contiguous stream which is subject to considerable regulation.

The mean annual rainfall of the Black river watershed at Felts Mills is 46.5 inches, of the Oswegatchie river watershed at Ogdensburg 36.2 inches. The mean monthly flows of the Oswegatchie river at Ogdensburg from May, 1903, to April, 1911, inclusive, were divided by the drainage area at Ogdensburg and multiplied by the ratio 46.5:36.2 and plotted in the form of a duration curve. The mean monthly flows of the Black river at Felts Mills for the same period were divided by the drainage area at Felts Mills and plotted in the form of a duration curve. In the low water season (summer season) it is noticed that the flow of the Black river at Felts Mills, as shown by the present actual gagings, is considerably greater than the natural flow as computed from the Oswegatchie river flows. This shows that the usable flow of the Black river under present conditions is considerably greater than the natural low water flow would have been.

Records of the gate openings and gage heights of water surface elevations have been kept at the Beaver river and Fulton Chain reservoirs since May, 1908. We have computed from these data the discharge through the gates and over the crests of the dams during the low water season of the years 1908, 1909 and 1910, and these results are given in the following tables. These three years, as far as the low water records were concerned, were the three driest years of which we have any records in New York State.

Discharge from Beaver River Reservoir.

	Mean Monthly Flow — Cu. Ft. per Second		
	1908	1909	1910
June	261	335	307
July	183	189	154
August	120	312	178
September	155	225	252
October	413	196	Records
November	278	210	Missing.

Discharge at Old Forge Dam (Fulton Chain Reservoirs).

	Mean Monthly Flow — Cu. Ft. per Second		
	1908	1909	1910
June	51	60	47
July	86	24	6

August	66	69	122
September	215	144	158
October	115	146	117
November	25	90	26

In November, 1911, a current meter gaging station was established by the Conservation Commission just below Old Forge Dam, and the records of the flow are available for November and December, 1911, and January and February, 1912, which serve as an independent check on the flow computed by the gate openings and gage heights. The following table gives the flow at this point as computed, and as measured.

1911	Computed Flow Mean Monthly Flow cu. ft. per sec.	Measured Flow Mean Monthly Flow cu. ft. per. sec.
November (9–30)	178	175
December	217	209
1912		
January	95	96
February	108	116

The mean of the flows for the three driest months in 1908, 1909 and 1910 of the discharge of both the Beaver river and Fulton Chain reservoirs is 259 cubic feet per second. The flow returned to the Black river from the canal is at least 65 cubic feet per second, a total of 324 cubic feet per second.

The total drainage area of the diverting and compensating reservoirs is, as previously noted, 486 square miles. To secure the natural stream flow from this drainage area we have used the stream flow records of the Sacandaga river at Wells for 1908 to 1910. The watershed of the Sacandaga river at Wells is somewhat regulated by the storage in Sacandaga lake and Lake Pleasant. The average rainfall on this watershed at this point is 45.1 inches. The average rainfall of the Black and Beaver river, Forestport and Fulton Chain reservoir watersheds is 48.8 inches. Thus, if we take the average flow of the Sacandaga river at Wells for the three driest months in each of the years 1908, 1909 and 1910, which is 0.31 cubic feet per second per square mile and increase this flow by the ratio

48.8:45.1 and multiply by the total drainage area (486 square miles) of the Forestport, Fulton Chain and Beaver river reservoirs, we get 150 cubic feet per second, which is the computed natural flow at these reservoirs for the same time for which we have computed the regulated flow. The regulated flow from the Beaver river and Fulton Chain reservoirs plus the inflow from the canal is, as previously noted, 324 cubic feet per second as opposed to a natural flow of 150 cubic feet per second, showing that the regulated flow in the three driest months is over twice as great as the natural flow would have been. The above applies in full only to the water powers below the junction of the Beaver and Black rivers.

As to the Lyons Falls power, the following is pertinent. The mean monthly regulated flow from the Fulton Chain reservoirs for average of the three driest months of the year — 1908, 1909 and 1910, is 42 cubic feet per second. The inflow from the canal is 65 cubic feet per second, a total of 107 cubic feet per second.

As noted above, the computed natural flow of the Black river for this period is 0.31 cubic feet per second per square mile, or a total of 108 cubic feet per second for the Fulton Chain and Forestport drainage areas, showing that for the three driest months of these years the present flow at Lyons Falls is just equal to what the natural flow would have been.

The average flow for the three driest months of the years 1908, 1909 and 1910 from the Old Forge reservoir, is, as above noted, only 42 cubic feet per second, but this is hardly a fair measure of the utility of that reservoir in view of the fact that in the months corresponding to these minimum flows the average of the corresponding flows at Moose river was 1.25 cubic feet per second per square mile, showing that the natural flow of the intermediate watershed was sufficient to run the mills with the addition of the 42 cubic feet per second from the Fulton Chain reservoirs.

As to the question of possible compensation due to the water powers on the Black river above the inflow of the Black river canal north, no further study has been made as it is apparent from the table of claims paid that these powers have been financially compensated, and therefore have no claim for compensation in kind.

From the foregoing we may sum up this matter as follows:

Ontario Hydro-Electric System — Niagara Falls — American Falls.
The source of power for the Niagara district transmission of the Hydro-Electric Commission is at Niagara Falls.

1st. The Court of Appeals has decided that the law of 1836 authorizing the construction of the Black river feeder contemplated a permanent diversion.

2d. Chapter 181 of the Laws of 1851 authorized the Canal Commissioners to build compensating reservoirs and provided that the water stored should be sufficient to cause a flow in the river "not less than the quantity which ordinarily flows in said river *during the summer.*"

3d. In 1857, while three of the reservoirs were in process of construction, the Legislature passed an act permitting the riparian owners to present claims for damages. A total of $66,016.75 was allowed, being in full for damages above Lyons Falls, and 65 per cent. for those below, a reduction of 35 per cent. having been made because of the compensating reservoirs then being constructed.

4th. It may be questioned whether the awards were made upon the basis of the compensation in kind that would result from the compensating reservoirs then in construction, or upon the basis of full compensation in kind as provided by the law of 1851. If the latter is claimed, however, it is not apparent why *any* damage should have been allowed and the award of 65 per cent. of the amount allowed by the appraisers is inexplicable.

5th. The "ordinary summer flow" of the Black river above Lyons Falls is 13,000 cubic feet per minute. The amount diverted from the watershed is 13,000 cubic feet per minute according to actual measurements made by the Barge Canal authorities. In strict accordance with the laws of 1851, there should be sufficient storage on the basin to return 13,000 cubic feet per minute for the three summer months. This would require a total available storage of 1,684,800,000 cubic feet.

6th. Had no money conpensation been made, the riparian owners would be entitled to the return to the river of the 13,000 cubic feet per minute during the entire coincidence of the low water period with the period of extraction for canal purposes, say, for the months of July, August, September, October and November. This would require a total available storage of 2,808,000,000 cubic feet.

7th. The total storage on the watershed is 3,437,000,000 cubic feet, or more than double that required by the law of 1851, and 629,000,000 cubic feet greater than is required to compensate the owners below the entrance of the Beaver river.

8th. Comparison of the actual present stream flow of the Black at Felts Mills with the Oswegatchie at Ogdensburg furnishes further evidence that the low water flows of the Black river are at least as great as they would naturally be.

9th. It is concluded —

(a) That riparian owners below the mouth of the Beaver river have been fully compensated in kind in addition to having received awards of cost and having been legally concluded by the awards of 1859.

(b) The riparian owners between the mouths of the Moose and Beaver rivers do not receive quite sufficient stored water to fully compensate them in kind, but they were legally concluded by the awards of 1859 from which they did not appeal.

(c) The riparian owners between the mouth of the Moose and Forestport, the place of diversion, received full compensation in the awards of 1859 and are legally concluded.

(d) Legally, the construction of the Fulton Chain and Beaver river reservoirs were gratuities on the part of the State to the power owners.

Studies of canal powers will be continued as the time of our engineering and legal forces will permit.

REPORT UPON THE CONSERVATION COMMISSION INVESTIGATION OF THE ONTARIO HYDRO-ELECTRIC SYSTEM.

Law Under Which the Ontario Work is Being Done.— In brief, the Power Commission Act of Ontario provides for the appointment of the Hydro-Electric Power Commission of Ontario, who are to supply power to the municipalities of the province upon their application. Upon the receipt of an application the Commission

Ontario Hydro-Electric System — Niagara Falls — Horseshoe Falls.
The source of power for the Niagara district transmission of the Hydro-Electric Commission is at Niagara Falls.

must make an estimate of the price at which the power can be supplied. This estimate must include the cost of generating and transmitting the current, including interest at 4 per cent. on all expenditures of the Commission, sinking fund charges on a thirty-year basis, line losses, and the cost of operating, maintaining, repairing, renewing and insuring the works. The council may then enter into a provisional contract for the power, the contract to become effective only upon the approval by the taxpayers at an election held for the purpose.

A municipality that has entered into a contract with the Commission may contract with other municipalities, or with any person or corporation for power. The Commission may also fix the rates charged by the municipality after notice and hearing.

Under the provisions of the Power Commission Act the Commission has built and is operating about 300 miles of high tension lines (110,000 volts) and about 100 miles of low tension lines (13,200 volts). Thirty-six municipalities aggregating 1,000,000 population are being supplied under this act and 100 more applications are on file. In addition to the system now being supplied from Niagara, seven other districts are already being served, or plans are under way to serve them. These districts are the Cobalt, Sudbury, Nipissing, Sturgeon Bay, Thunder Bay, Ottawa and Trent.

The Commission has spent $4,500,000, and the municipalities using power under the law have spent $6,500,000 in distribution systems, making a total present investment of $11,000,000. The chairman of the Commission states that this total will reach $50,000,000 within the next five years. The population of the province is about 2,500,000, so that the total investment will be $20.00 per capita.

For a description of the physical engineering features of the enterprise, the reader is referred to the subsequent pages of this report. Attention is called to the fact that the work carried out by the Ontario government through its Hydro-Electric Commission is a model of substantial, permanent, economical and completely successful construction. The system is a pronounced physical, economic and financial success, and is up to the last minute, or leads, in every detail.

The results of the operations of the Hydro-Electric Commission are:

1. The householder, merchant and manufacturer are getting double the power at the same total cost as formerly paid.

2. The cities and villages are much better lighted than before at less total cost.

3. The per capita cost of distribution plants in the cities varies from $5 to $10. (Compare this with the cost of municipal owned water-works costing from $20 to $30 per capita.)

4. At least in those places where results are available, the incomes are sufficient to cover all charges, so that these results have been attained without the imposition of any additional taxes.

5. With increasing use, decreasing charges will be possible, so that further reductions in rates are practically certain to follow.

6. In nearly all cases these results have been achieved without detriment to local companies so far as can be judged by their reports and the prices of their securities.

7. The savings to the consumers during the first year of operation have been estimated at $2,000,000.

The competition and the example of the Hydro-Electric Commission has led to increased efficiency in management. Having a monopoly, and the ever-present fear of showing too great earnings, there was little inducement for the old companies to apply the principles of scientific management to the business. Current was sold on the basis of what the traffic would bear. The hydro power is sold on the basis of cost of service and in meeting the competition the companies have adopted the same rates with the result that undesirable contracts costing more than they returned have been eliminated. In other matters than rates, the analysis and study induced by real unescapable competition have shown where large benefits can be secured at little or no cost. The competition is not intended to be destructive on the part of the municipalities, but simply regulative, and has resulted in healthy tissue in the place of the dry rot induced by monopoly.

To bring these results to the homes and business of a million people has required the use of a surprisingly small quantity of power, the maximum thus far (Oct. 1, 1912) used on the entire Niagara district system having been less than 28,000 horsepower.

Anyone looking for something from which future disaster to either the provincial hydro-electric scheme or the municipal distribution of the energy can be predicted, is likely to be disappointed, if he gives fair consideration to the facts as they exist, and the general economic problems that the scheme is designed to solve. It needs no professional to see that mechanically the lines and works are of the highest order of excellence, while the few interruptions to service show their efficiency. The excellence of the installations is too apparent to be disputed, and even those hit hardest by the competition introduced are compelled to admit this feature of the hydro-electric scheme. Proof of the superior quality of the Hydro-Electric Commission's plant was furnished on July 5, 1912, when a severe electric storm put the equipment of the Toronto Electric Company out of service for five hours and fifteen minutes. The street railway and lighting systems of the private companies were shut down, but no interruption of the service of the customers of the hydro system occurred.

With all these features of excellence and success, there is coupled that of financial stability. The general system has met all of its obligations, and has $50,000 laid aside for depreciation account. At the same time the contracting municipalities have been treated leniently, and the last cent has not been required in any case. An example of this is the nonenforcement of the clause of the contracts requiring the cities to pay for three-fourths the amount contracted for whether used or not. The amount used has been the basis of payment in every case.

Detail Technical Report.

DESCRIPTION OF GENERAL TRANSMISSION SYSTEM.

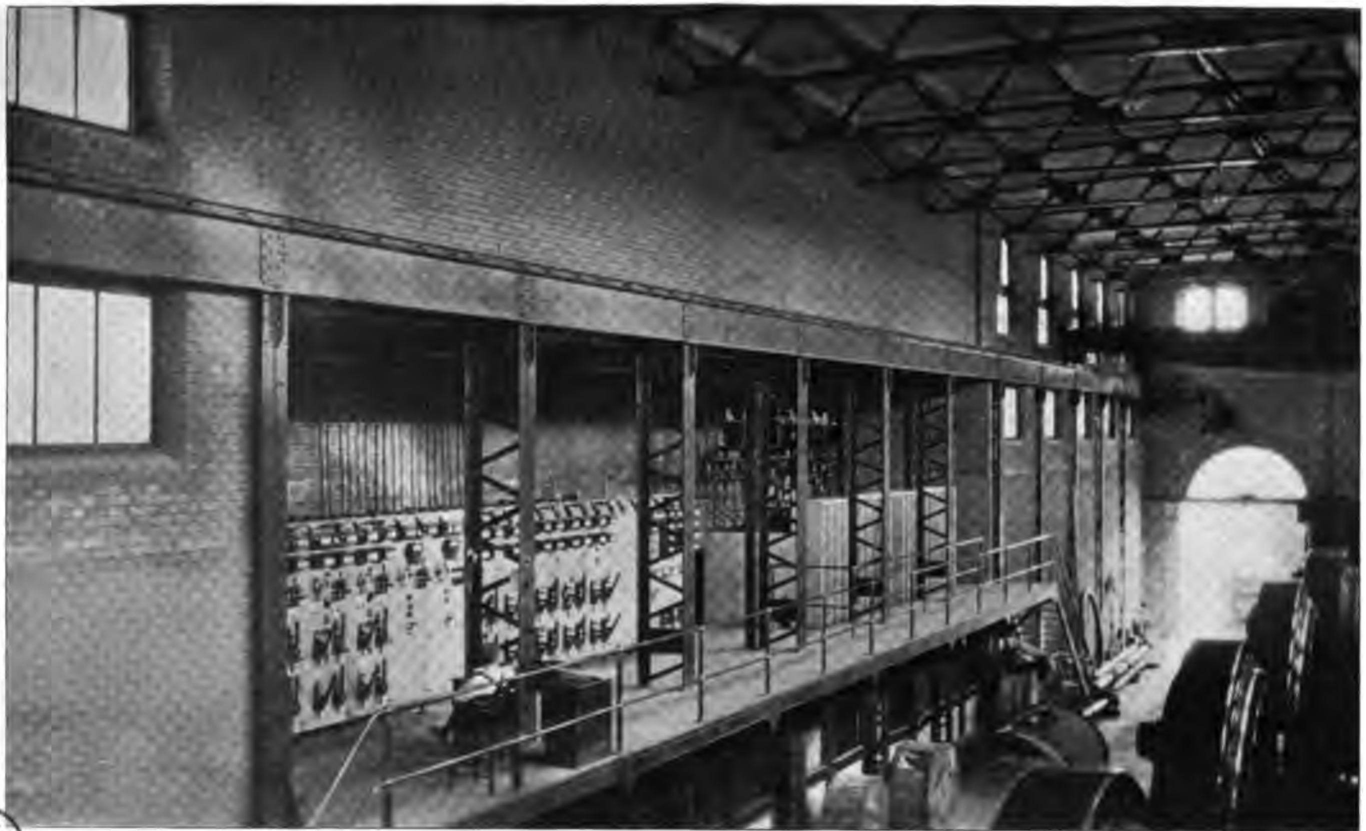
The Niagara District Transmission System.— The Ontario Power Commission which preceded the present Hydro-Electric Power Commission caused plans and estimates to be prepared by its engineers for the generation of power at Niagara. The engineers estimated that power could be delivered to 12,000 volt bus bars at $8.39 per horsepower for a 30,000 horsepower development, $5.89 per horsepower for a 60,000 horsepower development, and $4.95 per horsepower for a 100,000 horse power development.

The Hydro-Electric Power Commission at the inception of its work called for bids from the companies generating power on the Canadian side at Niagara Falls, and eventually made a contract with the Ontario Power Company to take three phase, 25 cycle power at the company's switchboard at 12,000 volts for $9.40 per horsepower for any quantity between 8,000 and 25,000 horsepower, and $9 per horsepower when the amount taken exceeds 25,000 horsepower. The power paid for is 75 per cent. of that reserved upon the order of the Commission, or in case the 20-minute peak load exceeds that amount in any month then the highest load continuing for twenty consecutive minutes is the amount to be paid for in the month. The highest peak thus far (to September 30, 1912) was about 20,000 horsepower.

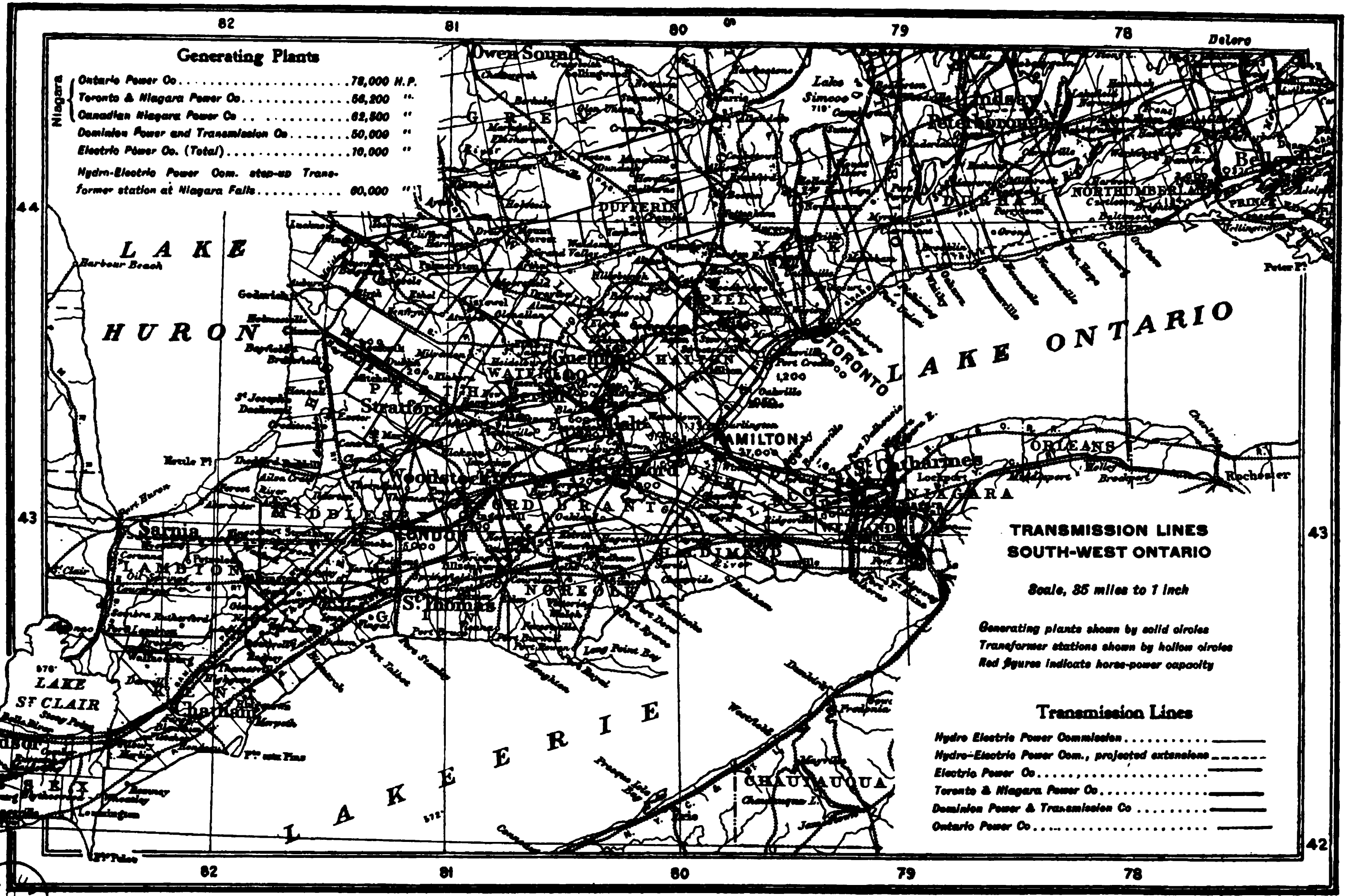
From the bus bars of the Ontario Power Company the current passes in underground conduits to the station of the Hydro-Electric Commission 2,500 feet away. Here are located the measuring and switching devices and the transformers which raise the voltage from 12,000 to 110,000 volts. This station in construction is typical of all the stations of the Hydro-Electric Commission. They are made of brick with concrete floors, steel stairways, etc., and are absolutely fire-proof throughout, and of the most permanent construction. The arrangement is compact and regular, and neat in appearance. It is not thought necessary nor desirable to give a technical description of the station and apparatus, though the information is available. It is sufficient to say that the handling of the 110,000 volts is accomplished with perfect ease and safety, and trouble of all kinds is of less frequent occurrence than on the systems carrying only 60,000 volts operating in the same neighborhood.

The Niagara station has a transformer capacity of 24,000 horsepower now installed, with room in the present building for 12,000 horsepower additional.

From the Niagara station the current is transmitted to Dundas, a distance of 51.5 miles, over a line of 60,000 horsepower capacity composed of six aluminum cables (two three-wire circuits) supported by the suspension type of insulators on galvanized steel towers averaging 65 feet in height. Here again one gets the immediate impression of substantial, permanent and serviceable con-



ONTARIO HYDRO-ELECTRIC SYSTEM.
Interior of Ottawa and Hull Company's Station.


Generating Plants
Niagara
Ontario Power Co. .... 78,000 H.P.
Toronto & Niagara Power Co. .... 56,200 "
Canadian Niagara Power Co .... 62,500 "
Dominion Power and Transmission Co .... 50,000 "
Electric Power Co. (Total) .... 10,000 "
Hydro-Electric Power Com. step-up Transformer station at Niagara Falls .... 60,000 "
TRANSMISSION LINES
SOUTH-WEST ONTARIO
Scale, 35 miles to 1 inch
Generating plants shown by solid circles
Transformer stations shown by hollow circles
Red figures indicate horse-power capacity
Transmission Lines
Hydro Electric Power Commission
Hydro-Electric Power Com., projected extensions
Electric Power Co
Toronto & Niagara Power Co
Dominion Power & Transmission Co
Ontario Power Co
LAKE HURON
LAKE ONTARIO
LAKE ERIE
LAKE ST CLAIR
TORONTO
HAMILTON
LONDON
Sarnia
Windsor
Chatham
Owen Sound
Stratford
Woodstock
Guelph
Galt
St. Catharines
St. Thomas
Peterborough
Rochester
DETROIT
44
43
42
82
81
80
79
78

struction. The only interruption of service from failure of line that has occurred, came when a contractor engaged in railway construction blew down two towers with a dynamite charge.

Dundas is the interswitching station for the system. From here the high tension lines diverge eastward to Toronto, northward and westward through Guelph, Stratford, etc., to London, and westward through Woodstock to London. The two latter lines meeting at London form a loop, so that London and points further west can be supplied in two ways. The total length of the high tension lines so far constructed is about 300 miles, the greatest distance from Niagara Falls being 135 miles. It is expected to carry the high tension lines on westward to Windsor, a distance of 128 miles, or a total distance from Niagara Falls of 263 miles.

At intervals along the high tension lines, current is taken off and transformed from 110,000 volts down to 13,200 volts for local distribution. These low voltage lines are wood pole construction and aggregate to date about 200 miles.

The accompanying map, Plate IX, shows the location of the lines.

Reports Upon Municipal Systems Visited.

OTTAWA.

Hydro-Electric History.— Hydro-electric history began in Ottawa in 1885 when the Ottawa Electric Company was granted a franchise. In 1888 the Chaudiere Electric Light & Power Company was also given a franchise, but was amalgamated with the Ottawa Electric Company in 1895. The city in 1900 again introduced competition in the electric light and power service in Ottawa, by granting a franchise to the Consumers Electric Company. A clause in the franchise provided for the purchase of the plant at any time by the city. The city's previous experiences in competition and subsequent amalgamation caused the introduction of the purchase clause in order to prevent a second amalgamation. From 1895 to 1901, the Ottawa Electric Company had enjoyed a monopoly, and the rates were maintained at 15 cents net per kilowatt-hour for light, $40 and up for power, and $65 per year for arc lamps on a moonlight schedule. The competition of the Consumers Company resulted in rate cutting so that in 1905 the

rates were 7½ cents net per kilowatt-hour for house lighting, $25 per horse-power for power, and $45 for arc lamps on a schedule of 4,000 hours per year. The Ottawa Electric Company claimed that the rates did not permit of a just return from the business, and sought amalgamation. The city succeeded in twice defeating a bill permitting the purchase of the Consumers Company's plant by the Ottawa Electric Company, but such a bill was eventually passed by the Dominion Parliament in 1904. Before the bill passed, however, the city exercised its purchase rights and bought out the plant of the Consumers Electric Company, paying $200,000 therefor. The plant purchased was only a distributing plant, and a contract for power was made with the Ottawa and Hull Electric Company. The right of this city to purchase current was attacked in the courts by the Ottawa Electric Company. The city was successful in the lower court but was defeated higher up, and was left with a plant into which $250,000 had been put, thus rendered useless without current. In the meantime, however, the Hydro-Electric Commission of Ontario had been created and clothed with sweeping powers. The city turned to the Commission for aid, and a contract was made by the Commission with the Ottawa and Hull Company for power, and at the same time with the city to take the power.

The original vote in 1905 authorizing the purchase of the plant was very close, the proposition having been carried by a majority of only 420. The vote to issue bonds for an extension in 1907 was carried by a majority of 5,500. This illustrates the rapidity of the growth of the hydro-electric sentiment

Including the original purchase price of $200,000 the city has spent $510,096.15 on the hydro-electric plant, etc., or $5.70 per capita. Of this sum $430,000, or $4.80 per capita, was raised by bonds.

Character of Plant. The new work put up by the city is well done. The poles acquired with the plant purchased are apparently in a very good state of preservation. There are five miles of "White Ways"— i. e., streets lighted by five light clusters, but no underground wiring exists except of the cables from the power house to the sub-station as explained below. They have but one sub-station. It is a fireproof structure, plain, but substantial and commodious in every respect.

Ontario Hydro-Electric System.
Ottawa Municipal Sub-Station.

There is an agreement between the city and the Ottawa Electric Company in virtue of which each uses the other's poles, paying one dollars per year per pole for such use. The larger number of poles are the property of the Ottawa Electric Company.

About two-thirds of the city is now covered by the hydro-electric residence lighting system, and it is estimated that it will cost $200,000.00 more to cover the entire city.

Current for the hydro-electric system is generated at the plant of the Ottawa and Hull Electric Company located on the west side of the Ottawa river in the Province of Quebec. For this power the city pays $15 per horsepower per year. The amount to be paid for is the largest number of horsepower used for ten consecutive minutes at any time during the year. There are in operation at this station three 1500 kilowatt, 2300 volt, 60 cycle, two phase generators and one 2000 kilowatt, 11,000 volt, 60 cycle, three phase generator, while another 2000 kilowatt, 11,000 volt, 60 cycle, three phase generator is being installed. The two phase 2300 volt and three phase 11,000 volt generators are inter-connected through transformers with Scott connections so that the whole plant is available for the city's three phase distribution system. The power is carried from the generating station to the sub-station, a distance of about 13,000 feet, by underground cables in duplicate, operating at 11,000 volts. One cable is operated and the other held in reserve, the capacity of each being 5,000 horsepower. The feeders from the sub-station are provided with potential regulators. The arc lighting system is operated from constant current transformers.

Street Lighting System. There are five miles of "White Ways" in the city. The agitation for these was begun by the Ottawa Electric Company who offered to install clusters of five 100 watt Tungsten lamps 100 feet apart on each side of the street and operate them at ten cents per front foot per month, to be paid by the property owners (20 cents per lineal foot of street). The hydro-electric system, after making estimates, offered to do it for five cents per front foot per month, the city to continue to pay the system for the arc lights displaced, making the total return to the hydro system about six cents per front foot. When the work was begun it was found that the cost for installa-

tion and operation was less than the estimate, and that for the price paid the clusters could be spaced 75 feet apart, so that this is the spacing as finally installed. The effect is very good indeed, and the great extent of this system indicates its popularity with the property owners who pay for it and can have it when a sufficient proportion requests its installation.

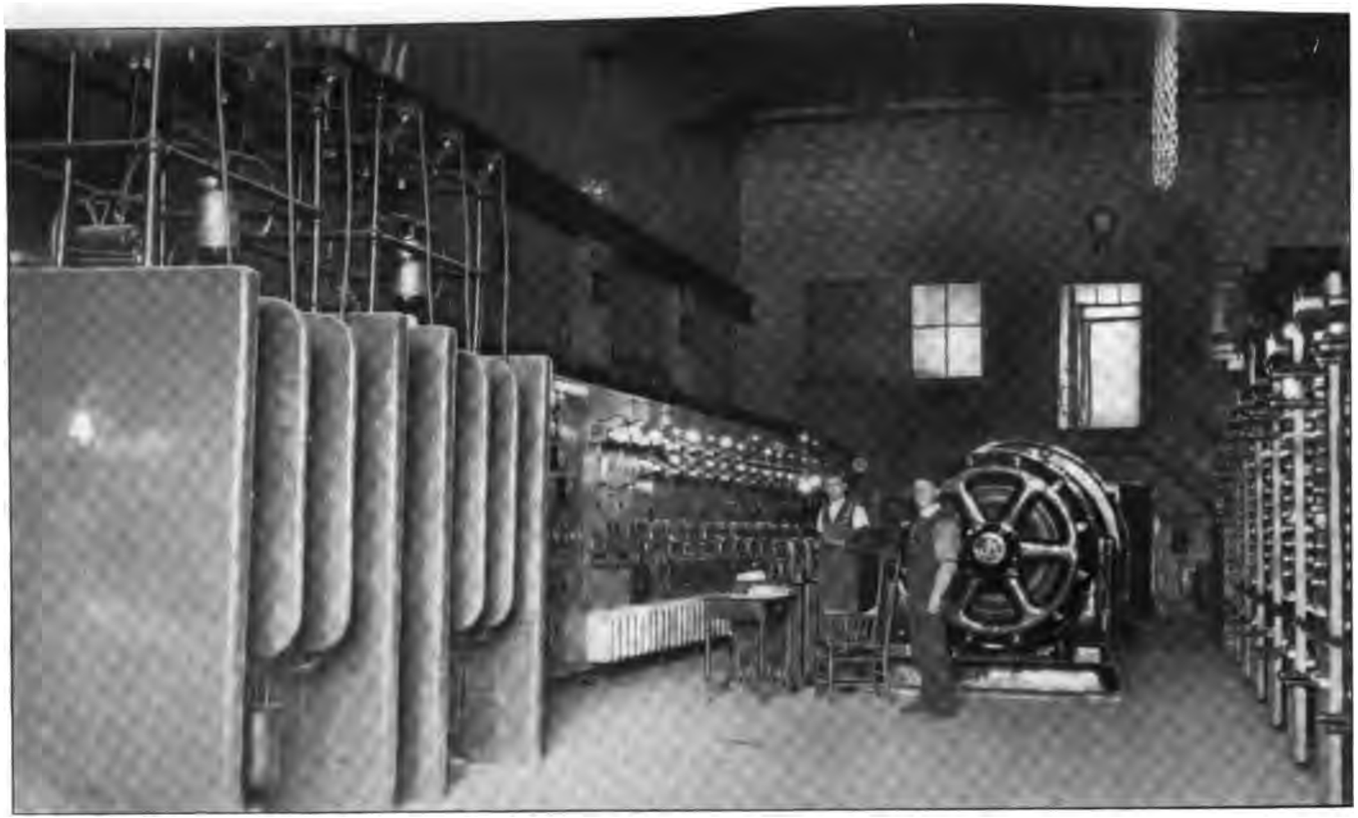
The streets not " White Ways " are lighted by alternating current arcs with the usual results. In our opinion, this system does not compare in real efficiency with that in use at Toronto. For the arcs the city pays the hydro-electric system $45.00 each per year, and City Commissioner, J. A. Ellis, states the cost is about $40.00 each.

The city pumps its water with waterpower produced by turbines direct connected to pumps, so that no electricity is used for this purpose, and Ottawa has no direct means of flattening its load curves in the manner used in most of the other Ontario cities.

Previous Electric System. When the city began the operation of its street lighting system, the streets were being lighted by the Consumers Electric Company with Adams-Bagnall enclosed arcs from Western Electric D. C. arc machines. There are six of these machines of a total capacity of 900 arcs. They were installed in 1901.

The alternating current purchased by the city could not be used in the direct current arc lamps, so that when the lighting contract ran out in 1907 the city removed the direct current lamps and replaced them with the alternating type. The six direct current arc machines cost $36,000 in 1901, and were sold for $3,600 in 1907. The arc lamps cost $25 each, and have not been sold, though it is stated the city has been offered $8 each for them. Here is an apparent economic waste amounting to about $40,000. It should be noted, however, that many managers of electric light companies are scrapping the low efficiency direct current arc machines and the direct current lamps and substituting the alternating current apparatus simply on the ground of decreased operating costs. This has been done in Albany during the past two years.

Plant of Ottawa Electric Co. The Company has three plants, two hydraulic and one steam plant used as auxiliary to the water-



ONTARIO HYDRO-ELECTRIC SYSTEM.
Interior of Ottawa Municipal Sub-Station.

power. In Station No. 1 there are four 700 kilowatt generators and in No. 2 there are two 1350 kilowatt generators, while in the steam plant there is one steam turbine of 1500 kilowatt capacity, and an addition of 4500 horsepower is being installed. This steam plant is to be used as a reserve and to carry the peaks in the winter time. The peak load in December, 1911, was 6,365 kilowatts. The company is now building a sub-station near the location of the city sub-station, and the distribution system will be about the same as that used by the city.

Stocks and Bonds of the Ottawa Electric Co. According to the report of the directors for the year 1911, the company has outstanding $750,000 of 5 per cent. bonds, and $1,500,000 of stock. In 1904–1905 the stock was worth 60. It is now said to be worth 150. The property and plant equipment is valued at $2,651,148.26, and the total assets are $2,958,147.85. The gross earnings for 1911 were $495,509.45. The operating expenses including interest on bonds were $279,625.87, giving a surplus for the year of $215,883.58. From this there were paid four dividends of 1¾ per cent. each and a bonus of 1 per cent., making a total dividend of 7 per cent. on the stock, and $100,000 was carried to reserve account, making the total reserve account of the company $450,000. This reserve account is in reality the depreciation account of the company, and would have amounted to $850,000 at the close of the year, but a stock dividend of $400,000 was issued to the stockholders in February, 1911. This is included in the total issue of $1,500,000 of stock as previously given.

Financial Statement of Municipal Hydro-Electric Department. The gross earnings of the city plant for the year ending December 31, 1911, were $153,102.83 and the gross operating expenses including cost of power, and interest and sinking fund for the bonds, were $125,386.56, leaving $27,716.27 for transfer to the depreciation account. On December 31, 1911, this depreciation account amounted to a total of $97,659.28. This figure is probably not far from the actual physical depreciation of the plant. The only actual profit made by the city, therefore, is the amount paid into the sinking fund, totaling $50,000 at the end of 1911. This may be considered as profit because the deprecia-

tion fund will replace the plant as it becomes worn out, and when the bonds are liquidated through the application of the sinking fund the plant will be still worth all that has been paid for it, and prices for light and power can be still further decreased, as no more interest or sinking fund charges will have to be made.

Loads of the City Plant. The city purchases its power at $15 per horsepower measured by the highest peak of ten minutes duration in the calendar year. To keep up its power factor, the city has installed in its sub-station a synchronous motor generator set which it uses at the time of highest peak. The peak load in December, 1911, was 3100 horsepower. The connected load is:

	H. P
Incandescent lamps	5930
Arc lamps	570
Motors	1110
Total	7610
Customers	5377

Ratio of connected load to peak load 2.45 to 1.

The average yearly load factor, that is, the ratio of the maximum peak load of the year to the average load of the year is apparently about 30 per cent. With this condition it would doubtless pay the city to install a steam plant to carry a few of its peaks. The contract with the present company is for only ten years, however, and the Hydro-Electric Power Commission of Ontario hopes to develop and transmit power to Ottawa before the expiration of the contract. The Commission is acquiring Chat's Falls, 30 miles away on the Ottawa river, where an ultimate development of 120,000 horsepower is contemplated. They hope that the Province of Quebec will cooperate with them in the development. There are other larger power possibilities within easy transmission distance of the city.

Rates. The rates of the city plant are house lighting, 4 cents per month per 100 square feet of area lighted and 3 cents per kilowatt hour for current consumed less 10 per cent. discount for payment within 15 days. No meter rental.

Ontario Hydro-Electric System.
" High-Level " Sub-Station — Toronto Municipal System.

Power rates

HORSEPOWER OF MOTORS OR PEAK LOAD	1 to 5	6 to 25	26 to 50	51 to 100	Over 100
Flat rates per horsepower per year, based on horsepower installed or maximum demand	$29 00	$28 00	$27 00	$26 00	$25 00
Differential rates					
Fixed charge per installed horsepower per year, or maximum demand	7 00	8 00	9 00	10 00	11 00
Meter rate per kw. hour of consumption	2	1¾	1½	1¼	1
Restricted class					
Restricted use 4 to 10 p. m., during months October to March, inclusive	20 00	19 00	18 00	17 00	16 00
Summer rates from April to September, inclusive	15 00	14 00	13 00	12 00	11 00

Ten per cent. discount for payment within fifteen days of all power rates.

The rates of the private company are practically identical and in some respects exactly so. They are intended to be strictly competitive, but it is stated that the city does not maintain an aggressive canvassing force. Commissioner Ellis states that the reason for the existence and continuance of the city plant is to act as a regulator of rates through competition, and that destructive competition is not contemplated nor desired by the department.

General Statement. Ottawa has a population of about 90,000, and being the capital of the Province is a residential city to a greater extent than it would be if it depended solely on its natural advantages as a manufacturing center.

The rates in force previous to October 1, 1911, were those that had been established by private competition. When the city took up the work it was to prevent the destruction of competition through amalgamation, and the city did not change the rates for five years. Then the surpluses had accumulated to such an extent that it was felt that a reduction in rates could be safely made. After an analysis of the situation it was found that the residence lighting was paying over half the gross income though using a considerable less proportion of the service, and it was determined to reduce that rate. Accordingly, the standard rate prepared by the Provincial Hydro-Electric Commission was adopted on Oct. 1, 1911. The residence rate was changed from a straight meter

rate of $7\frac{1}{2}$ per cent. net per kilowatt hour to a rate composed of a service charge of 4 cents per 100 square feet of area lighted plus 3 cents per kilowatt hour for current consumed, with 10 per cent. off both charges for prompt payment. Before making the change the bills of a large number of consumers were taken, the houses measured, and the total bill under the new rate computed. From this it was determined that the average rate would be 6 cents or 5.4 cents net per kilowatt hour, giving an average reduction of 27.5 per cent. As the house lighting pays $80,000 per year in revenue to the plant, the reduction in income would be $22,000 per year. It is anticipated, however, that the decreased rate will result in large increase in consumption, the tendency of the consumer being, in most cases, to increase his uses with decreased unit cost to such an extent as will keep the total lighting cost at about the same or a higher point. Besides this, the business is increasing in extent by the addition of new customers. The Ottawa Hydro-Electric Commissioner, Mr. J. A. Ellis, is fully conversant with the business and gave the matter full consideration before recommending the change in rate.

TORONTO.

Hydro-Electric History. The hydro-electric by-law authorizing the city of Toronto to enter into contract with the Hydro-Electric Commission for power from Niagara was voted upon Jan. 1, 1907, by the " rate " payers of the city. The vote was 11,026 for, and 2,907 opposed — ratio 3.8 to 1.

On Jan. 1, 1908, the taxpayers voted upon the question of bonding the city for $2,750,000 to begin the construction work upon the distributing plant. The vote was 15,048 for and 4,551 opposed — ratio 3.2 to 1.

The current was turned on to a part of the system about June 1, 1911.

On Jan. 1, 1912, the taxpayers voted upon the question of a further bond issue of $2,250,000 to complete the distributing plant. The vote was 17,605 for and 2,945 opposed — ratio 6 to 1.

Up to date the city has expended $3,500,000 and has covered about two-thirds of the city. The general manager of the Hydro-

Ontario Hydro-Electric System.
Toronto Terminal Station — Hydro-Electric Commission.

Electric Department of the city states that the $1,500,000 remaining available will finish the distribution system throughout the city and care for extensions for two years. This will make the per capita cost and bond issue for hydro-electric distribution about $12 per capita.

Character of Distribution Plant. The materials and workmanship of the distributing plant are clearly of the highest order of excellence. The 110,000 volt current is transformed down to 13,200 volts in the terminal of the Hydro-Electric Commission on the outskirts of the city. This station will be described in another place. From the terminal station the 13,200 volt current is carried to a ring of sub-stations, five in number, on the outskirts of the city. In the downtown section where other wires are underground, these 13,200 volt circuits are also underground. In the other sections they are carried on poles. From the sub-stations current is distributed from 2200 volt circuits. Some sections are also covered with three phase, 250-500 volt power circuits, and in a limited area downtown 500 volt direct current is also distributed. Both the plant capacity and area of distribution of this 500 volt direct current is limited, and the superintendent states that no effort is being made to extend the business, and the capacity and area served will not be extended. For the secondary distribution and street lighting circuits, 25,000 concrete poles have been used. They present a very neat appearance, and though somewhat more expensive in first cost are of course practically indestructible. They are 24 feet long, 8 inches square at the bottom, and 5 inches square at the top, with chamfered corners. The reinforcement consists of four half-inch rods. From a point near the top a pipe runs down the center of the pole to an outlet for the lantern enclosing the 100 watt street lamps. The poles cost about $5 each to manufacture, and $4 to cart and set up. A wooden pole would cost $2.50, and carted and erected $5.50 to $6. Fitting, painting, etc., brings the cost up to $7.50 to $8.

In addition, the city hydro-electric system has 8,000 to 9,000 wooden poles 50 feet high. On some of the principal streets the wires are carried in conduits situated under the center of the sidewalks on each side. In the construction of these conduits, sufficient capacity to care for the city's needs for all time was

installed. There are installed five circuits of 5,000 H. P. capacity each, and the ducts are laid for twenty such circuits.

The sub-stations are of most substantial construction, completely fireproof and of capacity ample for future installations of machinery sufficient to cover growth for a long time to come. (Opposite this page is a picture of the "high level" station.)

Street Lighting System.— The investigators of the Commission were very favorably impressed with the Toronto street lighting system. The principal business streets are lighted with clusters of five 100-watt Tungsten lamps on ornamental cast iron standards spaced about 100 feet apart on each side of the street. The lamps are enclosed in globes of Alba glass. The installation cost was about $80 to $90 per cluster exclusive of subways. This first cost was borne by the city, and the running expenses are also borne by the city. The side streets and residence districts are lighted with single 100-watt Tungsten lamps enclosed in translucent lanterns spaced about 100 feet apart on each side. About 25,000 100-watt lamps are now used by the city, 2,500 being in clusters. The city pays $9 per 100-watt lamp for the single lamps, and $52.50 per cluster. The city lighting cost was estimated at $260,000 for the year 1912, the extensions of the lighting now going on being included for part of the year.

City Pumping.— The city pumps all its water from Lake Ontario, and in this manner is able to flatten its load curve very materially, using power at off peak times. The total capacity of electric pumping machinery is 13,000 horsepower. The maximum load noted for pumping is given at 3,000 kilowatts. The price to be paid by the city for its pump service has not yet been determined.

Previous Lighting System.— Owing to the fact that the contract with the lighting company was so drawn that any extensions of the system acted as a renewal of the contract, the city had had the same number of lights for the streets during the period within which it had doubled in population. One thousand nine hundred arc lamps of an antiquated type were in use when the City Hydro-Electric Department began lighting the city, and at least double that number of modern high power arcs would have been necessary to properly light the entire city. For the old arcs the city paid $69 each per year.

On December 31, 1909, the Toronto Electric Light Company had 12,717 customers, a connected load equivalent to 780,000 16 candle-power lamps (39,000 kilowatts) and a peak load of 13,000 to 14,000 kilowatts. The present peak load is 18,000 to 20,000 kilowatts. The superintendent of the Toronto Electric Company is authority for the statement that the company is doing 30 per cent. more business at half the rate since the advent of the hydro-electric scheme.

Plant.— The Toronto Electric Company has twenty-four substations in Toronto. It has a contract for 24,000 horsepower of hydro-electric power, and a steam plant of 9,600 horsepower, 5,600 of which is in two steam turbines recently installed.

Stocks and Bonds.— The 1909 statement of the company gives the value of the plant at $5,681,733.97 against which there is $4,000,000 of stock and $1,000,000 of bonds. The stock has paid and continues to pay regularly 8 per cent, and was worth 171 in 1906. In 1909 the city offered the company 125 for its stock but was overbid by the Mackenzie-Mann interests, who bought it at 135. The stock cannot be bought at present, but it is said to be worth about 160. It is now stated that the power line from Niagara is to be doubled in capacity.

Loads of Hydro-Electric System.— The city originally contracted for 10,000 horsepower, but this was finally reduced to 6,000 horsepower. The highest twenty-minute peak load so far noted occurred in February or March, and was 9,500 horsepower. On May 8, 1912, the peak was 5,960 kilowatts with a power factor of 93 per cent. at the peak. The connected load is growing at the rate of from 200 to 900 horsepower per week. According to Mr. Ashworth, assistant manager, the total combined commercial load attached is 15,000 horsepower, requiring about 4,000 horsepower of actual peak to operate it, and having a load factor of 50 to 60 per cent.

To meet the growth in demand, the transformers installed only about a year ago in the Toronto terminal station, having a capacity of 7,500 kilowatts, are to be removed and transformers of double the capacity installed in their place.

The Toronto officials of both the hydro-electric and private plants were reticent in giving information because of the competi-

tive struggle now going on. The noting of this spirit made your engineers somewhat reticent in asking for such facts, hence the paucity of data of this class.

General Statements.— The city of Toronto is growing at an astonishing rate, the population in 1907 having been 272,000 by police census and 425,000 now by the same method of enumeration. This growth of population, the fact that the power was turned onto a part of the system last June, the fact that until a few weeks ago the work was under the direction of the City Council but has now been turned over to a City Hydro-Electric Commission, and the continuance of construction work concomitantly with the securing of business, all indicate the stress under which the engineers and managers have been working, and afford sufficient reasons for the lack of analyses of loads, costs, etc.

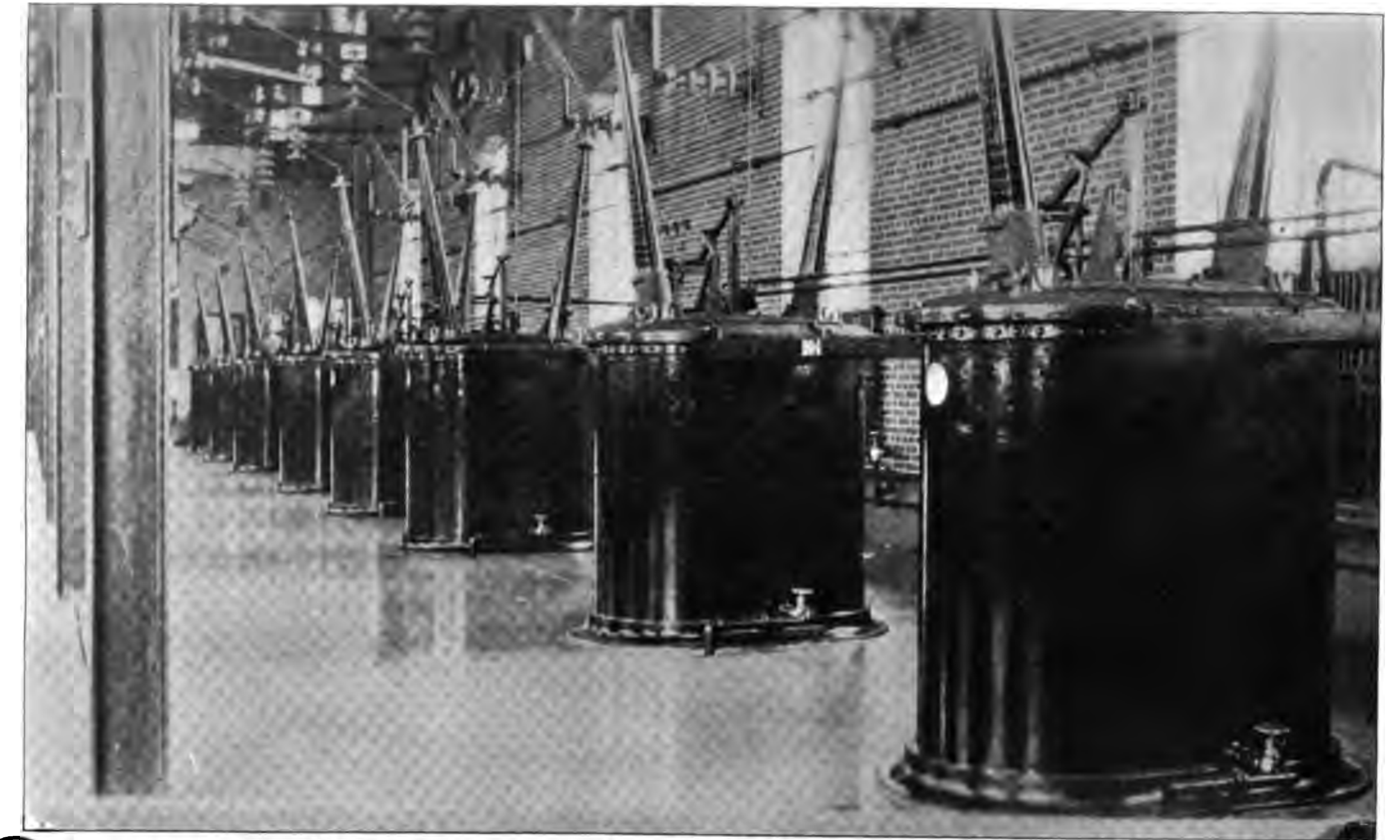
Rates.— The city rates for current are as follows:

Residence Lighting.— A monthly service charge of 4 cents per hundred square feet of floor area plus an energy charge of 3 cents per kilowatt hour, subject to a discount of 10 per cent. if paid on or before the 10th day after issue date on bill.

Commercial Lighting.— Eight cents per kilowatt hour for the first 30 hours monthly use of the maximum demand, and all excess at 3 cents per kilowatt hour, subject to a discount of 10 per cent. to 20 per cent. (depending on length of contract) if paid on or before the 10th day after issue date on bill. In any event, the minimum monthly bill is $1.00 net for each kilowatt of maximum demand.

Three Phase Power, 550 *Volts.*— Monthly service charge of $1.35 per H. P. of maximum demand for the first 10 H. P., and $1 per H. P. of maximum demand for all excess, plus an energy charge of 1½ cents per kilowatt hour for the first 50 hours monthly use of the maximum demand, 1 cent per kilowatt hour for the next succeeding 50 hours monthly use of the maximum demand, and ½ cent per kilowatt hour for all excess, subject to a discount of from 10 per cent. to 20 per cent. (depending on length of contract) if paid on or before the 10th day after issue date on bill.

The city rates and the rates of the private company are intended to be the same though there are some minor points which



Ontario Hydro-Electric System.
Interior View of Dundas Interswitching Station — 110,000 Volt Switches.

are probably worked by both sides to give quite substantial concessions.

In general, it may be stated that a general result of the introduction of hydro-electric service has been to adjust rates more nearly according to "cost of service," and further away from "what traffic will bear." This is especially true of commercial lighting and power rates. In the case of house lighting, it is exceedingly difficult to approximate closely to such a rate, and the fixed charge for area lighted plus meter rate method is only a compromise intended to produce an average result from which there will be wide variations, some individual contracts being profitable to the user while others pay more than they should on a strict cost of service basis.

The cost of service basis causes some anomalies from the standpoint of the user. One firm paid an average of 40 cents per kilowatt hour for current, while another paid only 1.3 cents per kilowatt hour. In the first case there were several small motors run only at intervals. The maximum demand and cost of service were estimated and were large, while the small use of current made the return for current small. In the second case, the user had a curve drawing watt meter, and the service charge was based upon the maximum shown by the watt meter. At the same time the current was used steadily, making the current charge large in proportion to the service charge.

As to the average results, it was stated that residence lighting rates average 5.4 cents per kilowatt hour net and power rates 2.5 cents per kilowatt hour.

Stated generally, nearly all customers of the hydro-electric system were agreed that they obtain twice the power or light at the same total cost that they paid previous to the installation of the hydro-electric system. Herein lies the explanation of the fact that the local company remains prosperous in spite of the reduction of rates. The cost of serving twice the volume of current within the same area of distribution is but very little more. This is especially true in the case of scattered small loads such as house lighting. The tendency has not been so much to reduce bills as to increase use, while the advertising value of the hydro-electric movement has been of the greatest value for business ex-

tension to the private company. The general sharpening of wits due to competition and the consequent analysis of business costs and rearrangement of charges, have also had important results in economy, efficiency and character of service. Many unprofitable contracts have been eliminated upon a just comprehension of the cost of the service given. These matters of apparently minor importance have had, most far reaching effects. If the scrapping of antiquated machinery be considered an economic loss, the increased efficiency in the use of the rest of the plant and the new machinery is an economic gain which may, and very probably has, offset the loss. In the meantime, the public has had an enormous benefit.

DUNDAS.

Hydro-Electric History.— The question of entering into contract with the Hydro-Electric Commission of Ontario for power for lighting and manufacturing purposes was submitted to the rate payers in 1909. The vote was 313 for and 50 opposed — ratio 6.2 to 1. On account of an illegality of procedure the question had to be submitted again in 1910, when the vote was 362 for and 57 opposed — ratio 6.35 to 1.

The question of issuing $12,000 bonds for distribution was put in 1911. The vote was 347 for and 42 opposed — ratio 8.25 to 1.

In these elections there were said to have been many forms of attempts at coercion practiced by the opposition.

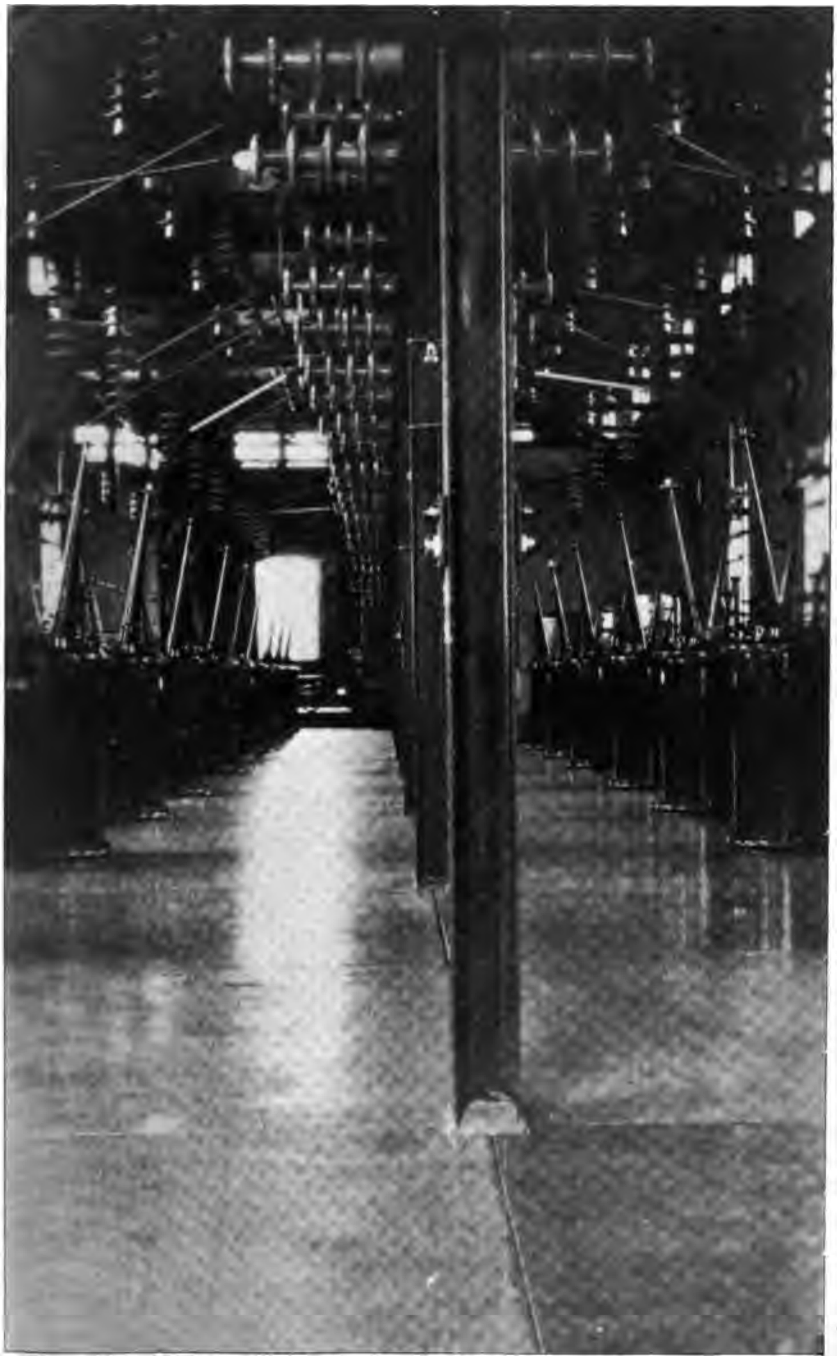
The power was first turned on in Dundas January 5, 1911.

The city has spent $20,000 on the distributing system and will have to spend $8,000 more for the street lighting system. The present street lighting contract expires December 1, 1913.

Character of Plant.— Dundas is the main interswitching station of the Provincial 110,000 volt circuit, and furnishes current at 13,200 volts to Dundas and Hamilton. The Dundas current is again transformed down to 2,200 volts in the Dundas station. The engineering for the city plant has been done by the Provincial engineers, and the Dundas station presents the usual condition of substantial thoroughgoing construction.

The city pays $17 per H. P. under the standard contract.

Sixty-four H. P. are used in the arc lighting system from the Dominion Power and Transmission Company. This amount will



ONTARIO HYDRO-ELECTRIC COMMISSION.
Interior View of Dundas Interswitching Station — 110,000 Volt Switches.

be greatly increased by additional lighting when the city begins to do its own street lighting.

Private Plants.—The electric system is served by the Dominion Power and Transmission Company, and the rates are the same as those given in Hamilton.

The city is also served with natural gas at 40 cents per 1,000. This of course gives strong competition with electricity for domestic and commercial lighting. Lack of cleanliness is, however, a severe handicap to this gas light.

Loads on City Plant.— The city has 200 residential customers with a present peak load of 200 H. P., but they are connecting more load rapidly. One customer, a Canadian branch of the Niles Tool Company, has contracted for the hydro power and is replacing its 60 cycle motors with 25 cycle. This company will use an average of 308 H. P. ten hours per day. The estimate made by their engineers to determine the desirability of changing from the Dominion Power and Transmission Company to the hydro power was as follows:

Cost of power for 4 years past	$27,008 15
Estimate — 4 years.	
3,056,788 H. P. hours, at ½ cents	$15,283 94
Meter rental (not to be paid)	168 00
Cost per H. P. $12.56.	
Interest on capital expenditure $10,000, 6 per cent.	$2,400 00
Depreciation 50 per cent.	5,000 00
	$22,851 94
Saving in 4 years	4,156 21
Total	$27,008 15

The company is given a special rate of one-half cent per kilowatt hour, but must furnish its own transformers and line to the Dundas interswitching station. They are installing about 1,000 H. P. of motors.

Rates.—The Dundas rates are the standard base rates with 33⅓ per cent. discount.

Previous to 1907 the rates for house lighting were 20 cents with 50 per cent. off for prompt payment.

General Statement.—Dundas has a population of 4,326. There are in use in the city about 2,000 H. P. The city does not at present do any pumping, so that its load factor is probably quite low.

The Hydro-Electric Commission of Ontario has considered the scheme of building a reservoir on a high hill at Dundas, installing motors and pumps to pump water up to the reservoir from the lake level at off peak times, and water wheels and dynamos for using the water from the reservoir to generate current to help at the time of peak load. The motor could be used as a dynamo, but the pump would not be efficient as a turbine. This outfit was mentioned as a "hydraulic accumulator" in the 1909 report. Nothing has been done thus far on the project. Pumping loads are such a large proportion of the present loads in several municipalities that by keeping the pumps off at the peak and using them at low load times, a very flat load curve is attainable. Hence, the necessity for the hydraulic accumulator is not now so great as it may ultimately become.

HAMILTON.

The city hydro-electric system is in process of construction, and thus far there is only a temporary system of wiring installed on the poles of the telephone company and the electric company. The pumping of the city water from the hydro-electric power of the Ontario Commission was begun about a year ago. Two 450 kilowatt synchronous motors are installed. In the winter, one unit does the work, but in summer both are required. This, of course, is advantageous to the Hydro-Electric Commission, as the winter pumping peak is small when the winter lighting peak will be large. It is proposed to install more motors and pumps so that the whole plant may be shut down at the time of maximum peak load. The city pays the Ontario Hydro-Electric Commission $17.92 per H. P. measured on the monthly peak. The contract is for 1,000 H. P., but very much more will be required when the

lighting system is in full operation. The present street lighting contract does not expire until 1914.

The Consulting Engineer's report dated May 19, 1911, shows that the estimate for a distribution system for Hamilton will cost $502,878. This is $5.50 per capita. The system figured upon will provide:

1. For street lighting, double the light now used.

2. A residence lighting system covering the entire city, and of capacity for 1,000 consumers.

3. A power system ready to serve power to any applicant within the city limits and for 1,000 H. P. of motors.

4. A commercial lighting system ready to serve 200 consumers within the city limits.

5. An underground service covering the business section of the city with room for telegraph and other wires, and a reserve capacity sufficient to accommodate the growth of that section for practically all time to come. To operate this system, together with the municipal lighting, pumping and power, will require 3,051 H. P. from the Provincial system. The street lighting system is to consist of —

Four hundred five-light ornamental iron standards equipped with five 100-watt Tungsten lamps 100 feet apart, on each side of the street.

Three hundred and eleven one-light ornamental standards 100 feet apart on each side, using one 100-watt lamp.

Six thousand six hundred and thirty-six one-light ornamental brackets on concrete distribution poles, equipped with 100-watt lamps. These lamps will be spaced 100 feet apart on both sides on streets occupied by the street railway and on one side on other streets.

Nine and one-half miles more of streets will be lighted than at present, and growth to 1914 has been allowed for. " This makes a total of 8,947 100-watt Tungsten lamps to be operated by the city at an annual cost, including operation, interest, sinking fund, maintenance, renewals, depreciation and power, of $63,684." At rates now charged by the company for smaller quantities the cost would be $168,940 per year.

The engineer estimates that the proposed rates for residence lighting will be 36.2 per cent. less than those now in effect, basing

his statement upon the bills of those now using the light from the Hamilton Cataract Power, Light and Traction Company.

The operating revenues (and expenses) are estimated at $150,-025, of which the city is to pay $82,729.

A table is given showing by what percentages each class of lighting would be cheapened by greater use of the system than that estimated upon.

CLASS OF LIGHTING	Per cent reduction 3,051 horsepower used	4,000 horsepower used	5,000 horsepower used	10,000 horsepower used
		Per cent	Per cent	Per cent
Street lighting	0	1.02	6.3	22
Residence lighting	0	14	17	29.5
Commercial lighting	0	20	32.2	37.7
Power	0	27	33.8	35

These figures do not include probable reduction in cost of power to city — only distribution decreased cost.

Rates.— The rates so far given by the hydro-electric system are those adopted by the Provincial Hydro-Electric Commission with 10 per cent. discount for prompt payment. They will be found in the appendix of this report.

The Dominion Power and Transmission Company, Ltd.— This company supplies power for all purposes in Hamilton, Dundas, Grimsby, Brantford and Welland. It is a holding company and through its subsidiaries has purchased or acquired outstanding rights to use 1,100 cubic feet of water per second from the Welland canal. For the greater part of this the company pays the government $30 per second foot per year. The operating head is 256 feet, which would give about 23.5 horsepower per second foot, so that the government charge amounts to 1.27½ per horsepower per year. The company has provided pondage so that the night flow is available for day use. With a load factor of 64.3 their maximum capacity would be 40,000 H. P., and the government charge on this basis $0.82 per H. P. Their peak load was 23,600 killowatts in December, 1911, and that was 42 per cent. of their connected load, i. e., the ratio of installed load to peak load = 2.4 to 1.

General Statement.— Hamilton has a population of 90,000.

It presents a very interesting phase of the hydro-electric movement. Power is produced by the private company under exceptionally favorable conditions from the Welland canal, and there was every reason for exceptionally low prices for light and power. As a matter of fact, the company has given cheap rates for power to private consumers for motor uses in large blocks. The schedule of prices in force for lighting when the Hydro-Electric Commission came into the field was, however, higher than in Toronto, 90 miles from the source of hydro power. The two schedules as previously given in the address of the Hon. Adam Beck, were:

SERVICE	Hamilton	Toronto
House lighting	10 cents, kw. hour	8 cents, kw. hour.
Commercial lighting	15 cents, kw. hour	12 cents, kw. hour.
Arc lamps	$84 per annum	$69.35 per annum.

The result of the entrance of the Hydro-Electric Commission into the field was the lowering of rates to their present level, the lowering of arc lighting to $47 per light per year by five-year contract with the company, while the city pumping went to the Commission, the company's bid having been $45 per H. P. per year.

The company offered to supply the city at rates 10 per cent. less than those charged by the Commission to any other municipality, but this did not befog the ratepayers as to the value of introducing and maintaining the competition of the Hydro-Electric Commission, and they have voted for a contract with the Commission in spite of the offer of the company.

LONDON.

Hydro-Electric History.— The city voted upon the question of entering into a contract with the Hydro Commission in 1907. The vote was 2,701 in favor and 576 opposed. The following year they voted upon the question of issuing $235,000 of bonds for a distribution plant. This vote was 2,769 for and 950 opposed.

Power was first turned onto the distributing system December 1, 1910. At the end of the first year the system had 3,000 customers and it now has 4,000.

Financial Statement.— The city has spent $325,000 on its distributing system and must spend about $66,000 more to com-

plete it, making the total cost $391,000, or about $8 per capita. This is exclusive of its subways and cluster lighting system on the business streets which has been installed as a local improvement on a front foot basis. Neither does it include sums paid for the installation of electric pumping apparatus, this expenditure being charged to the water works system, the capitalized reduction in pumping expenses being more than the capital cost.

An interesting feature relating to the underground work should be noted in passing. The superintendent of the hydro system is authority for the statement that because of the removal of overhead wires insurance rates have been cut by an amount sufficient to pay all fixed charges on the cost of conduits.

The city hydro system pays $28 per H. P. to the Provincial Commission for power at 13,200 volts at the city limits 122 miles from Niagara Falls.

The total earnings of the plant for the year ending November 30, 1911, were $78,892.16, of which the city paid $43,297.90; for light, $31,366.60; and power, $11,931.30.

The expenditures were $72,500, including interest and sinking fund on the cost of the distribution system, leaving a surplus of $6,392.16 applicable to depreciation account. The expenses also include $7,477.98 paid for business promotion. It should be noted that this first year's statement means but little, as the system was increasing its business from the street lighting load only, to its present condition.

General Description of Plant.— In London the water works and hydro-electric are under one general manager, and two of the sub-stations are in the pumping plants. The city pumps all of its water. The water works system as a whole is most interesting and worthy of study, but is foreign to our present subject. The pumping load is used to flatten the load curve and does so very effectively. The power at one pumping plant costs the city slightly less than was formerly paid for coal, and the city saves the wages of two men.

The stations are models of neat, thoroughly substantial and permanent construction. The old steam, gas and hydraulic pumping apparatus is retained as auxiliary and as much pumping is done with water power at the Spring Brook station as can be done with the flow available in the Thames river.

In No. 1 sub-station, which is combined with the Beck pumping station, the hydro system has 9 — 250 K. V. A. 13,200 — 2,300 — 575 volt water cooled transformers, four potential regulators for keeping the voltage constant on the feeders, and ten constant current regulators for operating street lamps.

In No. 2 sub-station there are 3 — 200 K. V. A. 13,200 — 2,300 — 575-volt self-cooling transformers, and

In the Spring Brook station there are 3 — 250 K. V. A. 13,200 — 2,300 — 575-volt water-cooled transformers.

The distribution system covers 120 miles, using 4,870 poles and having 236 miles of circuit divided as follows:

	Miles.
13,200 volts	10
2,300 volts power lines	7
550 volts power lines	9
2,300 volts lighting lines	21
220 110-volt lighting lines	85
2,300 volt Tungsten street	104
Total	236
Total miles of copper	500

Street Lighting System.— As previously noted, the business portion of the city is lighted by five-light clusters of 100-watt Tungsten lamps on ornamental cast iron standards installed by local assessments on the front foot basis. The city furnishes the current for the "White Ways" without charge to the abutting owners, but pays the hydro system at the same rate as is charged to private consumers. There are 86 of these five-light clusters spaced about 125 feet centers on each side of the street, making about a mile of "White Way." The effect is good, though of course not equal to the Toronto and Ottawa results because of the greater distance apart.

The parks are lighted by ornamental one-light standards bearing 100-watt lamps, and served by underground cables. There are 37 of these lights.

The bulk of the street lighting is done by 75-watt Tungsten lamps operated in series on brackets attached to the distribution poles. They are spaced about 125 feet centers, and 1,901 of them are used. They are unprotected by globes and the result is not as effective as the Toronto system. For the light the city pays the hydro system about $30,000 per year, which is at the rate of about $15 per 100-watt lamp.

Rates.— The standard rates of the Hydro-Electric Commission have not been put into effect in London, residence rates being 5 cents per killowatt hour less 10 per cent. for cash, or 4.5 cents net per killowatt hour. They were formerly 18 cents less 50 per cent for cash, or 9 cents net. In the commercial lighting business there has been even a greater reduction in rates, and the competition is keen. In one instance of a hotel, the rate was reduced from $2,100 per year to $1,000, though the former rate was 5 cents per killowatt hour.

Loads, Etc.—As previously stated, the load factor is kept high (70 per cent. to 80 per cent.) by the manipulation of the pumping load. The total connected load September 30, 1911, was 6,000 H. P., and the corresponding peak load 2,080 H. P.— ratio 2.88 to 1. The superintendent in his report states that one large source of profit derived by the city is its sale of power to the customer at rates based on his peak loads, because the combination of these peak loads results in a station peak load of only two-thirds as much as the aggregate of the peak loads of the customers.

The Hydro-Electric Commission of Ontario collects only on the monthly peak loads, disregarding the minimum load clause of the contract, exhibiting here as elsewhere the liberality of its policy.

The hydro-electric system is expecting to get some further large contracts including street railways.

The London Electric Company, Ltd.— This company's equipment is not fitted for the competition to which it is being subjected. Its plant is antiquated and proper progressive management would have discarded it before. With no incentive to economic management as a result of monopoly, apparatus that should have been thrown on the junk heap long before now is still in use.

Ontario Hydro-Electric System.
Municipal Station at Woodstock.

ONTARIO HYDRO-ELECTRIC SYSTEM.
Woodstock Sub-Station.

The alternating current is at 125 cycles, consisting of three 100 kilowatt 1,000-volt single phase, and two 60 kilowatt 1,000-volt single phase belted dynamos. They have also two 300 kilowatt belted, three 200 kilowatt direct connected, one 100 kilowatt belted direct current generators for light and power. The steam engines are all of the reciprocating type, aggregating 2,400 H. P. in capacity.

The plant has 2,800 customers, and made $44,000 profit in 1910. They have 2,000 customers now, but had a deficit last year.

It is rumored that the Mackenzie interests have purchased the system and will install modern steam turbines and supply power to the street railway system also, possibly bringing some of the power from Niagara.

General Statement.— The population of London is about 50,000. It is too soon to draw any final conclusions from operating results in London. From the excellent character of the construction that has been done, however, and the evident effect on prices, together with the excellent showing of business for the first year, it is apparent that the success of the plant is assured.

Gas sold at $1 per thousand is a strong competitor of electricity for light and heat. The plant is in good condition, and bears evidence of strong, progressive management.

WOODSTOCK.

Hydro-Electric History.— Woodstock has had a municipal plant since 1901, at which time it purchased the plant of the local company at a cost of $14,000 and combined the generating station with the city's pumping plant.

Financial Statement.— The total capital account of the electric plant December 31, 1911, was $110,219.03. This included the principal expenditures made to adapt the system to the 25 cycle power as explained later. The total assets December 31, 1911, were $138,466.33. The liabilities were $97,385.63 of bonds, and $41,080.70 sinking fund, etc.

The total income for 1911 was $40,463.47; the surplus applicable to depreciation after paying operating expenses, interest and sinking fund charge, was $8,458.74.

General Description of Plant.— From the Woodstock terminal station of the Ontario Hydro-Electric system, current is supplied to Woodstock, Ingersoll, Norwich and Tilsonberg at 13,200 volts. The terminal station is of the usual character of construction. In a room in one corner of the building are installed the three 375 kilowatts, 13,200 — 2,200 volt transformers for the Woodstock service, with a fourth spare transformer ready to install when necessary.

The city system was 60 cycle, and in view of the necessity of maintaining a man at the pumping station, and the fact that the city already had the 60 cycle generator, it was determined to put in a 25 cycle, 475 H. P. motor to run the 60 cycle generator for light and power distribution. For the pumping, 2 — 25 cycle, 175 H. P. synchronous motors were installed. The boilers and the old engines consisting of a 250 H. P. engine belted to a dynamo and one 225 H. P. belted to pumps, were left in place, and one boiler is kept under steam with banked fire so that the pumping and lighting service can be thrown onto the steam plant in a very short time in case of break down of the hydro service.

The city's pumping and lighting apparatus is housed in a substantial brick building shown in the accompanying photograph.

Loads, etc.— The peak load for 1911 was 850 H. P. Since then it has been as high as 900 kilowatts. At present it is about 600 kilowatts. Through manipulation of pumping load the load factor averages about 70 per cent., but of course the yearly load factor would be considerably less. The contract with the Province is for 1,200 H. P. at $26 per H. P., but it is stated that here, as elsewhere, the city is not compelled to pay for anything more than its monthly peak load whether the peak amounts to 60 per cent. of the amount contracted for or less, though their contract would compel them to do so. The incandescent lights in use are the equivalent of 12,000 — 16 c. p., and the growth of the business was about 14 per cent. for 1911. The total connected motor load is 1,360 H. P. Eighty commercial arcs are in use. Thus the total connected load is

Incandescent	960 H. P.
Arcs	120 H. P.

Ontario Hydro-Electric System.
Woodstock Sub-Station.

Tungsten street lamps........................	100 H. P.
Motors	1,360 H. P.
	2,540 H. P.

Ratio of connected load to peak load=3 to 1. There are 654 customers.

Street Lighting System.— The city is now lighted by 90 arcs and clusters, and 100 — 75 watt Tungsten bracket lamps. On the principal business streets an underground system and five light clusters on ornamental cast iron standards are now being installed. The method of installation is novel. The sidewalk slabs are being raised with tackle and the conduits run along just inside the curb. The construction is very cheap.

The city pays the electric light department $60 per arc lamp per year. The city pays the electric system for power used in pumping at the same rate that private consumers are charged on a ten-hour basis, viz., $29.16 net per H. P. per year.

Rates.— The residence lighting rate was, until recently 10 cents per kilowatt hour, with 20 per cent. discount for prompt payment. It is now 3 cents per 100 square feet of area lighted plus a meter rate of 4 cents per kilowatt hour, with 20 per cent. discount for prompt payment. This is estimated to amount to about 6.5 cents per kilowatt hour on the average.

The rates for power are the Commission's standard rates, less 10 per cent., with the usual additional 10 per cent. discount for prompt payment.

General Statement.— The population of Woodstock is 10,000. The water works and electric light services are operated upon a conservative but efficient and progressive business basis. The appearance of the plant with its surrounding grounds would be sufficient proof if no other evidence were available.

WINNIPEG.

The city of Winnipeg, the capitol of the Province of Manitoba, is situated at the junction of the Red and the Assiniboia rivers, almost midway between the Atlantic and Pacific oceans. It is

the greatest grain center on the American continent and is the commercial, wholesale and manufacturing center of the Canadian northwest. The area of the city is 14,720 acres and in January, 1912, the population was 175,000. The rate of taxation is 13.25 mills, with a total bonded indebtedness of $22,851,585 net. There are in the city limits 381 miles of graded streets, of which 119 miles are either paved with asphalt or macadam.

The distribution system for private street lighting is planned to cover the entire city. Prior to 1906, electric light and electric power were generated from steam and supplied by the Winnipeg Electric Railroad Company, a private corporation, at prices ranging from 20 cents per kilowatt for house lighting to 12 cents per kilowatt for power.

A very bitter feeling arose between the city and the private company in regard to the price of electric power and in regard to the manner of the treatment of the citizens by the company. This resulted in the agitation for the ownership and operation by the city of its own power plant. Before this agitation had proceeded very far, the city invited tenders (by public advertising) for supplying the city with cheap electrical power. The best offer which they received was the offer of a block of 3,000 H. P. to be used for municipal purposes only, at the rate of $50 per H. P. per year; and this offer was coupled with the proviso that the company should have the free use of the streets for distribution purposes for fifty years without consideration.

This offer was refused and thereupon the private company reduced its rates to 10 cents per kilowatt with 10 per cent. discount for lighting, and a very substantial reduction for power rates. At this time (in 1907) the private company had constructed a hydro-electric system with a power plant on the Winnipeg river. The reduction in the price of electric power was not made voluntarily by the private company but was only made in the effort to block the city in the building of its own plant.

The city was authorized by a vote of the citizens in June, 1906, to proceed with the construction of a municipal plant. Plans were drawn and estimates furnished by competent constructing electrical engineers, who stated that the current could be supplied for private lighting at 3 cents per kilowatt and for power at ⅝ to

7/8 cents per kilowatt hour. These estimates and statements were bitterly contested by the private company, which claimed that the figures were ridiculous and that the current could not be furnished at any such price.

The engineers selected for the city a site at Point du Bois on the Winnipeg river, 77 miles from the city. The estimated cost of development at that point was $3,250,000 and the contract was let for the general work in January, 1909. The construction and equipment of the system, including transmission lines, terminal station and the operation of the distribution lines in the city, was completed on October 16, 1911, and after a thirty days test, the plant was turned over to the city. Since that date the plant has been operated by the city without a single interruption of any kind.

The original plant in full development was to have been 60,000 H. P. with the initial development of 17,000 H. P. However, in order to accommodate the increased demand for power, the plans were changed and the first development now consists of 28,000 H. P. ready for delivery, with the ultimate capacity of the plant above 100,000 H. P. and if the necessity arises, the city can increase this amount indefinitely up to a half million horsepower.

The work now completed includes all of the general works, such as dams, weirs, forebay, tailrace, intake and rock piers, for full installation, and half of the power house construction.

The city owns all the land and water rights at the site, together with a private right of way 77 miles in length and 100 feet wide with the transformer station and distribution station in the city of Winnipeg.

The plant as constructed is a very effective system in every detail, remarkable for its permanency and high efficiency and the ease with which the system can be expanded. The power house is constructed entirely of reinforced concrete and the size of the building is 250 feet long, 150 feet wide and 100 feet high. The area of the power site is 438 acres and the area of the flooded lands 4,422 acres. The building is planned to accommodate eight generators, with the necessary exciters, transformers and switching apparatus. At present there are installed five generators, which on test are capable of delivering over 4,000 kilowatts each.

The power is generated at 6,600 volts at 60 cycles, being stepped up to 60,000 volts for transmission. The transmission line is carried on steel towers set on concrete bases. These towers are of two types — braced and flexible — the braced towers being set about 1,200 feet apart and the flexible towers taxing the sag between them.

The cables are nineteen strand aluminum, with four shell composite insulators set on steel pins.

The terminal station at Winnipeg is designed to take care of the entire output of the complete plant. Thirteen thousand-volt cables are run to outlying substations in special conduits, while the general distribution throughout the city is at from 110 to 2,200 volts carried either in ducts or on pole lines. There is also supplied a direct current service for elevators and other installation requiring this class of energy.

The cost of the work from the power plant to the low tension side of the city treminals was originally estimated at $3,250,000, but owing to the fact that a larger amount of permanent work for future development was done, it cost $3,400,000. It is estimated that the entire cost both of the power plant and of the city distribution plant will be $5,000,000.

The cost of power delivered to the bus-bars of the distribution system is $12 per H. P. and the estimated expense of distributing this power throughout the city is $6 per H. P. As power is sold at no profit, the city is thus enabled to sell it at $18 per H. P. At present, there is but one-fourth of the estimated amount of power that can be used and it is estimated that when the additional machinery provided for in the present building is installed the cost will be further decreased and the final installation will again make a reduction in price.

At present light for private lighting costs 3 cents per kilowatt with a 20 per cent. discount for a five years contract. Power in amounts of 100 H. P. and over is sold at ½ cent per kilowatt hour. The rates to the city for pumping and for street lighting is ⅞ cent per kilowatt. A special rate is made for cooking by electricity. The rate is 1 cent per kilowatt hour subject to a net minimum monthly payment of 75 cents per kilowatt and a discount of 10 per cent for prompt payment, if bills are paid within

ten days from date. This current is on a separate meter. In all probability, this rate for cooking reduces the price of cooking under that of coal by perhaps one-half. The bills for private lighting are based on a minimum of 50 cents per month and all bills for power are based on a minimum of $1,000 per H. P. installed per month.

Cost of Operation.

The plant has been operated by the city since October, 1911, and the deficit has been constantly reduced each month until it is estimated that when the system shall have been in operation for one year, it will be on a self-sustaining basis.

In the month of July, 1912, the actual cost of operation was $31,281 while the revenue for the same period was $27,000, of which amount the city paid $7,800 for pumping water and lighting the streets. It may be noticed in this connection that the city has been delayed, owing to a mistake in the order for supplies, in connecting many of the large users of power. None of the large hotels and much of the congested city business district are not as yet supplied by the city with either light or power. The present revenue is derived from the sale of about one-fourth of the developed power, as the peak in July was only 4,600 H. P.

It is estimated that at the prices charged by the city for light and power, the citizens will have saved $600,000 in light and power bills during the first year of operation of the city plant.

There are at present 12,000 city connections and during the past month new connections have been made at the rate of about 100 per day. The city has a force of canvassers and it is estimated that each connection costs the city about an average of $1.

The private company charges the same rates as the city.

There is very little power now generated by steam and what there is is estimated to cost about $100 per horsepower. The price which the city charges for power averages about $35 per horsepower. This is for twenty-four hour power every day in the week; and at the prices with the discount for a ten-hour day, the price is $14.60 per horsepower.

Winnipeg Electric Railway Company.

This company is the active competitor of the municipal system for furnishing light and power in Winnipeg. The company was incorporated in 1892 with a capital of $300,000 and in 1911 the capital had been increased to $6,000,000, not including debentures (or bonds) and paid 12 per cent. dividend. This stock sells today at 229¾. The company carried over into 1912 a surplus of $1,500,000. The bonded indebtedness is $5,000,000 with debenture stock of $2,450,000, a total investment of bonds and stock of $16,000,000.

This company operates the street railroads and gas plant and the hydro-electric power system and charges $1.20 per M. for gas for cooking and the same rate as the city, one cent per killowatt hour for electricity for cooking.

In 1911 the company had 30,000 customers and made a gross earning for lighting of $771,500. In 1912, it has sold 3,000 killowatt more than in the same period in 1911. In 1911 the peak was almost 40,000 horsepower.

The company owns a hydro-electric system on the Winnipeg river at a point just below the plant of the municipal system and the two transmission lines parallel each other to the city. The private company has an auxiliary steam plant of 20,000 horsepower and has 28,000 horsepower from its hydro-electric system.

It is stated by the officials of the city and by citizens who were questioned that the private company had developed their maximum amount of power on the Winnipeg river and that this was one of the reasons why the city was induced to build its municipal plant.

Summary.

The striking features of the municipal system may be summarized as follows:

1. Average flow of river, cu. ft. per sec.	25,000
2. Average head, feet	47
3. Present installation, horsepower	28,000
4. Full capacity of present building, horsepower	45,000
5. Ultimate installation, horsepower	90,000
6. Cost without distribution	$3,400,000

7. Cost with distribution	$5,000,000
8. Present cost of power delivered in Winnipeg, 13,000 volts	12 00
9. Cost of power, full capacity present building, low tension, Winnipeg	10 00
10. Estimated revenue for 1913	550,000
11. Cost of operating and fixed charges per month	35,000
12. Revenue for month of July, 1912	27,000

Approximately 25 per cent. of the output sold.

LIGHT AND POWER — CITY OF WINNIPEG,
WINNIPEG, CANADA, *August* 15, 1912.

COMPTROLLER COCKBURN, *City Hall, City:*

DEAR SIR.— Enclosed please find approximate statement of business connected up to date:

Number of customers connected nearly 12,000.

Estimated connected load in power, 68,458 horsepower (including city pumping).

Estimated connected load in lighting, 11,855 kilowatts (including city street lighting).

Estimated total connected load, 63,195 kilowats.

Yours very truly,
CITY LIGHT AND POWER DEPARTMENT.
R. A. SARA, *Sales Manager.*

LOAD RECORD FOR JULY 19TH, 1912.

Total, 77,500 kilowatt hours.

Division.

	kw. hrs.
Street lighting	6,000
W. W. Department	26,000
Commercial	45,000
Station service	350
	77,500

Peak load, 5,600 killowatts.

Division.	kw.
Street lights	1,100
W. W. Department	1,400
Commercial	3,100
	5,600

Load factor, 60 per cent.

CITY OF WINNIPEG IN ACCOUNT WITH THE CITY LIGHT AND POWER DEPARTMENT.

To electric power for pumping — July, 1912.

No. 6 well:				
July 31	159			
June 30	71.51			
	87.49	x 1,000	....	87,490
No. 8 well:				
Estimated			....	241,862
McPhillips Street pumping station:				
July 31	729.3			
June 30	346			
	383.3	x 1,000	383,300	
Less lighting.				
Pump house No. 1:				
July 31	23,881			
June 30	21,959			
		1,922		
Pump house No. 2:				
July 31	8,341			
July 30	8,062			
		279		
Power-house:				
July 31	12,320			
June 30	11,910			
		310		
Power.				
McPhillips street subway		866		
July 31	148			
June 30	24			
	124 x 10 =	1,240	4,617	
				378,683
				708,035 kw. at ½-cents net.

GENERAL PLAN FOR STATEWIDE POWER GENERATION AND TRANSMISSION.

The map, Plate I, shows a tentative sketch for main transmission lines to be operated at high tension. From convenient points will radiate secondary transmission circuits of 33,000 volts or less. Some of the principal sources of power to be developed in the initiation of the scheme would be as follows:

WESTERN CIRCUIT.

Development at Portage (75,000 H. P.) and Barge canal at Rochester (5,000 to 25,000 H. P.) both owned by the State.

CENTRAL CIRCUIT.

Supplied from Rochester and Portage, and from developments at Seneca Falls, Fulton (5,000 H. P.), Minetto, and Oswego (10,000 H. P.).

The 5,000 H. P. at Fulton has been adjudicated and belongs to the State. The powers at Seneca Falls, Minetto and Oswego have not been adjudicated, but are believed to belong in part, at least, to the State.

EASTERN AND SOUTHERN CIRCUITS.

Supplied from Crescent (12,000 H. P.), Vischer's Ferry (12,000 H. P.), Troy dam (12,000 H. P.), Waterford dam (7,600 H. P.), Delta dam (2,300 H. P.), Nine-Mile creek developments (5,300 H. P.), Little Falls (1,500 H. P.), Mindenville (2,300 H. P.), Sacandaga reservoir (80,000 H. P.), Indian river and Kettle mountain projects (100,000 H. P.). These powers belong to the State, with the exception of Sacandaga reservoir, and this will belong to the State if the policy of the Commission is adopted.

Thus, for the initiation of the complete scheme, the State has immediately available 325,000 or more horsepower, concerning the ownership of which there is no question. This will supply all the demands likely to come upon the system for several years, and is more than ample to serve the purpose until adjudication is had upon other sources.

When required, the power would be supplemented from Niagara, Long Sault, Upper Sacandaga and other more remote sources.

REPORT OF THE CONSERVATION COMMISSION ON THE SUBJECT OF HIGH AND LOW WATER IN LAKE GEORGE.

ALBANY, N. Y., *April* 7, 1913.

Hon. ALFRED E. SMITH, *Speaker of Assembly, Albany, N. Y.:*

DEAR SIR.— In compliance with the provisions of chapter 255 of the Laws of 1912, which reads as follows:

Section 1. The Conservation Commission is hereby directed to investigate the causes of unusual high and low water at Lake George, peculiar to such lake, and to report its opinion thereon to the Legislature at its regular session in the year nineteen hundred and thirteen, accompanied with recommendations as to legislation adopted to correcting conditions which may be the cause of such high and low water. Such Commission may, for the purpose of such investigattion, employ expert assistants; but a list of such assistants, together with their proposed salaries, shall be submitted to the Governor for his approval in the same manner as the members of the office force of the Conservation Department as provided in section three of the Conservation Law. Such list may be submitted at any time. The compensation of such assistants shall be paid out of moneys appropriated for salaries of subordinates in the Department of Conservation.

§ 2. This act shall take effect immediately.

The Conservation Commission has caused careful investigations and studies of the high and low water conditions of Lake George to be made, and finds:

Lake George has a drainage area of 227 square miles, including the water surface of the lake itself which is 43.6 square miles.

On the outlet of Lake George a dam has existed for so long a time (said to be over 100 years) that we are unable to learn the date of its original construction. Probably the surface elevation of the lake was affected by the first dam, and has been by all subsequent constructions made in lieu thereof. At the present time the International Paper Company controls the dam which is a concrete structure with a weir 80 feet long, and has flashboards extending 8 inches above the concrete crest.

If no water passed from the lake excepting over the dam, the water would not fall below the crest, unless by reason of strong south winds or evaporation it were to fall a little below it. The water is drawn down by the International Paper Company in the operation of their mills. The extreme drafts brought the level to 28 inches below the crest on December 17, 1908, which was the lowest recorded since 1899. The water would have fallen

as low but would not have fallen any lower if the dam had not existed. While the dam causes the water of the lake to hold at higher elevations than would occur under natural conditions during nearly all of the time, it never causes it to be lower than would occur under such conditions. As to high water, it is improbable that under natural conditions it would ever rise higher than the elevation of the crest of the concrete dam.

The International Paper Company try to control the out-flow of the lake so as to derive power from the entire quantity of water, and in a marked degree succeed in doing so. The water flows over the top of the flashboards during only a small part of the time, as is shown by the records, as follows:

On May 1, 1909, the elevation was 7 inches above that of the flashboards; on June 1st of the same year it was 5 inches; and on June 1, 1912, it was 3 inches. In 1910 and 1911 the water did not reach as high as the top of the flashboards. The height given above the top of flashboards and above or below the crest of the dam are in all cases based on the water in the lake itself above the outlet channel. During the exceptionally high water period in the spring of 1909 the flashboards were removed and restored when the flood had subsided. There are two large flood gates in the dam which are used to control high water when necessary. Since 1898 the International Paper Company's dam has not caused the water to rise at any time more than 15 inches higher than it would have risen under natural conditions.

In the matter of extreme low and extreme high water as it would have been under natural conditions, and as it has been with the dam, the effect is on the high water extreme only, and raises the water 15 inches higher than natural conditions would cause. The general effect on the elevation of the lake surface of the dam of the International Paper Company is to maintain a higher level in the surface of the lake over a much greater portion of the time than would occur under natural conditions.

The International Paper Company, as indicated by the records of the surface elevation of the lake, is careful and considerate of the interests of navigation on the lake, and by reason of their dam and their control and regulation of the water, navigation on the lake is better than it would be without the dam and regulation.

The extreme difference in the height of low and high water in the last thirteen (13) years has been 43 inches. The extreme difference under natural conditions would have been 28 inches. The difference of 15 inches in high water is due to the dam of the International Paper Company.

The waters of Lake George flowing from it into Lake Champlain, with a fall of 221 feet, are used in developing power almost to the possible maximum limit.

The business life, and almost the existence of Ticonderoga, are dependent upon this great water power. The only interests that could be injured by the control of the lake waters are those of navigation (including all boats) on Lake George, and the shore interests.

It appears by a careful study of the records of the water surface of the lake that the regulation and control of the waters by means of the dam and gates at the outlet is decidedly beneficial to navigation and interests on and surrounding the lake generally.

A hydrograph drawing of the water conditions of the lake from December 31, 1908, to December 1, 1912, is attached hereto as part of this report.

It is recommended that conditions as to the waters of Lake George be allowed to continue as has been the custom during at least the past four (4) years, and that legislation on the subject is at present unnecessary.

Very respectfully,
CONSERVATION COMMISSION.

By

GEO. E. VAN KENNEN,
Chairman.

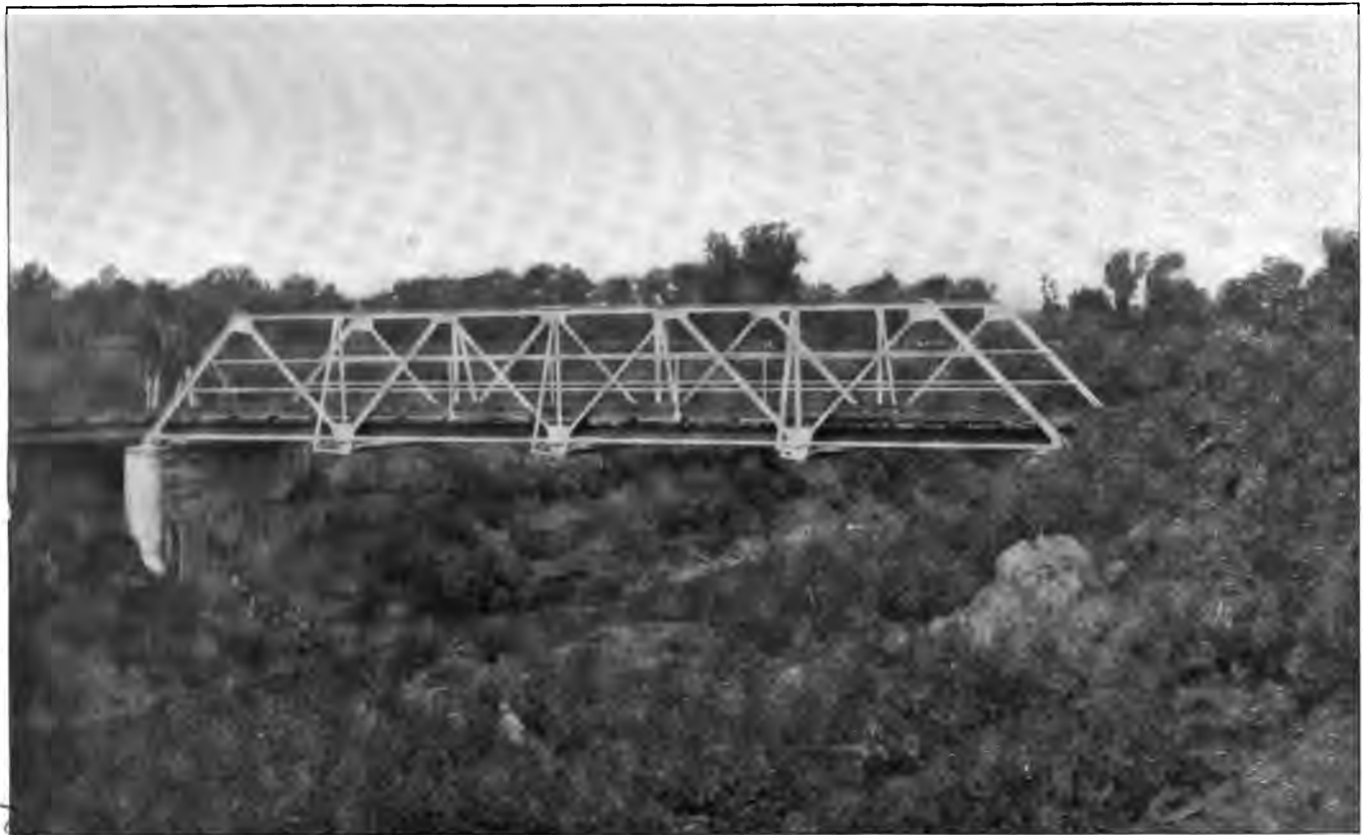
JAMES W. FLEMING,
Commissioner.

JOHN D. MOORE,
Commissioner.

River Improvement — Canaseraga Creek Project.
Dredged Channel — The old channel shown in the right of the picture.

River Improvement — Canaseraga Creek Project.
Dredged Channel.

River Improvement — Canaseraga Creek Project.
Dredged Channel.



River Improvement — Canaseraga Creek Project.
Farm Bridge

III. RIVER IMPROVEMENT.

Canaseraga Creek Project.

Benefit from Work Already Done.— On the Canaseraga creek project, the expected benefits from drainage and flood protection are already beginning to be realized. Lands through which the new channel has been cut, which up to a year ago had never been plowed and afforded very poor pasture, are growing excellent crops. Other lands which had been cultivated to some extent but had been wet and heavy, are now much drier and lighter, easier to cultivate and producing much better crops. On this last class of lands, the marked degree of improvement is not nearly as noticeable to casual observers who may visit the lands a few times a year as it is to the land owners and others who pass over them constantly.

July 9th there was a cloud-burst to the south of Dansville, causing a flood in the Canaseraga. Part of the Groveland highway was washed out and other damage done, but the lands along that part of the creek which had been dredged out which were far enough up stream to be unaffected by the backing up of water by the dredge, were not flooded though the land owners state that in former years a similar flood would have covered their lands with from 2 to 3 feet of water.

Dredging of the Main Channel. October 1, 1911, the two yard dipper dredge had reached a point 8400 feet from the starting point and had excavated 54,000 cubic yards of material. On December 12th, having moved 9000 feet farther down stream or 3¼ miles from its starting point, it broke both of its spuds and backed 1500 feet up stream to where repairs could be more easily made. The extreme cold weather delayed the repairs till February 15th, by which time there was so much ice ahead, the dredge could not work up to the face of the cut and thus it was the middle of March before dredging could be resumed.

By September 1st, the dredge had reached the D. L. & W. R. R. bridge 6½ miles from its starting point and had excavated 226,000 cubic yards of material. Here the dredge had to be dismantled to pass under the railroad bridge and this work was still in progress on September 30th.

Dredging of the Laterals. On June 1st, the contractor had shipped in a part of a one yard dipper dredge and started to assemble it at the head of Bradner creek. On August 1st, he began dredging and on September 30th had moved 2½ miles down stream and had excavated 34,000 cubic yards of material.

Excavation on East Mud Run was started the middle of July with teams and hand labor and by September 30th about one-half mile of channel had been partially excavated and 1,700 cubic yards of material removed.

Dredging Yet to be Done. The total distance of main channel to be dredged is 15½ miles of which 6½ miles had been finished by September 30th. The total distance of laterals to be excavated is 19½ miles, of which 3 miles had been finished by September 30th. As the heaviest excavation is being done first, the remainder of the mileage will go at a much faster rate.

Bridges. Up to September 30, 1912, four farm and one highway bridges had been practically completed. Each consisted of a 60 foot main span with two 16 foot approaches, the superstructures being of steel and the substructures concrete piers on piles.

IV. DRAINAGE.

The above subject is covered by Article 8 of the Conservation Law.

The theory of this law is that action may be taken under it by the Conservation Commission for the purpose of draining any swamp, bog, pond, meadow, or other low or wet lands, if such work is necessary for "either the public health or the public safety, or the public welfare, or all or any of them."

The Commission may proceed upon its own motion or upon the petition made by any county, city, town, or village in which such wet lands are located, or by any person or persons possessing such lands, or person or persons in the vicinity thereof. Petition must be verified under oath, and must set forth the facts showing that the swamp, bog, pond, meadow, or other low or wet lands, are a menace to the public health, safety, or welfare, and that

River Improvement — Canaseraga Creek Project.
Swamp lands that will be drained upon completion of work.

RIVER IMPROVEMENT — CANASERAGA CREEK PROJECT.
Swamp lands that will be drained upon completion of the work.

River Improvement — Canaseraga Creek Project.
Swamp lands that will be drained. Note the dead trees, killed by the gradual silting up of the old channel.

it is necessary for the conservation of the public health and safety, or the conservation of the public welfare, to drain or improve the same. Following a petition the Conservation Commission is to determine whether the proposed improvement is of sufficient importance to the public health or safety, or sufficiently conducive to the public welfare, to warrant interference by the State under the provisions of said Article 8.

The law further makes provision at length and in detail as to the procedure for carrying out the improvement, levying assessments, and raising funds for the purpose of paying therefor. The whole law (under Article 8 aforesaid) is based upon the drainage improvement being necessary to "either the public health or the public safety, or the public welfare, or all or any of them."

Swamps, low wet lands, and lands periodically inundated by floods are admittedly, in greater or less degree, a menace to health. Destruction or injury to growing crops, and consequent diminution in the productiveness of the lands, is a menace to public safety, and the more so the larger the area affected may be. That which is detrimental to health or to safety, or to both, is a condition opposed to public welfare.

In a general way, the provisions of Article 7 of the Conservation Law for river improvement are somewhat similar to Article 8 on drainage. The Canaseraga creek improvement in Livingston county has become the subject of litigation, the plaintiff undertaking to establish his allegation that public health, saftey, and welfare were not the real purposes of the improvement. The trial court held with the plaintiff, and the case has now gone to the Appellate Division on appeal. The Commission feels confident that the trial court will be reversed.*

During the fiscal year a survey was made of some low lands known as Webster's Crossing swamp in Livingston county. This swamp is about one-half muck land and the remainder loam, and contains about 325 acres. It is estimated that the cost of the improvement would be $55 per acre, and that the cost of clearing, breaking up, plowing, and bringing into a state of cultivation

* At the November, 1912, term the Appellate Division handed down its decision reversing the trial court, and the case is now before the Court of Appeals.

would amount to $30 per acre, making a total of $85 per acre, or possibly $100 per acre. It is a question whether the landowners would be willing to stand an expense of $100 per acre. However, the land is of very little value at present, and in all probability would be worth $200 per acre if the improvement were made, and the lands put into a state of cultivation.

Some other swamp schemes have been brought to the attention of the Commission, among them being the following:

Near the outlet of Silver lake at Perry.

Black Creek swamp north of Lyons.

Some low lands along the canal and railroad near Macedon.

A large swamp area above Pope Mills near Black lake, in St. Lawrence county.

A small drainage scheme near Hagaman, north of Amsterdam.

These projects have not advanced beyond the making of some very preliminary examinations, and no definite action has been taken by the Commission as yet in these matters, as the proceedings on the part of the landowners have all been of a very informal character.

Unless drainage schemes are on a large scale, it seems advisable for interested parties to act in concert among themselves, as small drainage schemes can be more quickly and economically carried out through mutual agreements between neighbors and interested parties than in any other way. That large areas can in many cases be successfully drained under the Conservation Law, and at great benefit to all interests concerned, the Commission is confident.

V. WATER SUPPLY AND SEWERAGE.

A list of the water supply applications acted upon during the year and recommendations for changes in laws were given on p. 47. The decisions rendered by the commission and memoranda on water supply applications will be found in appendix D.

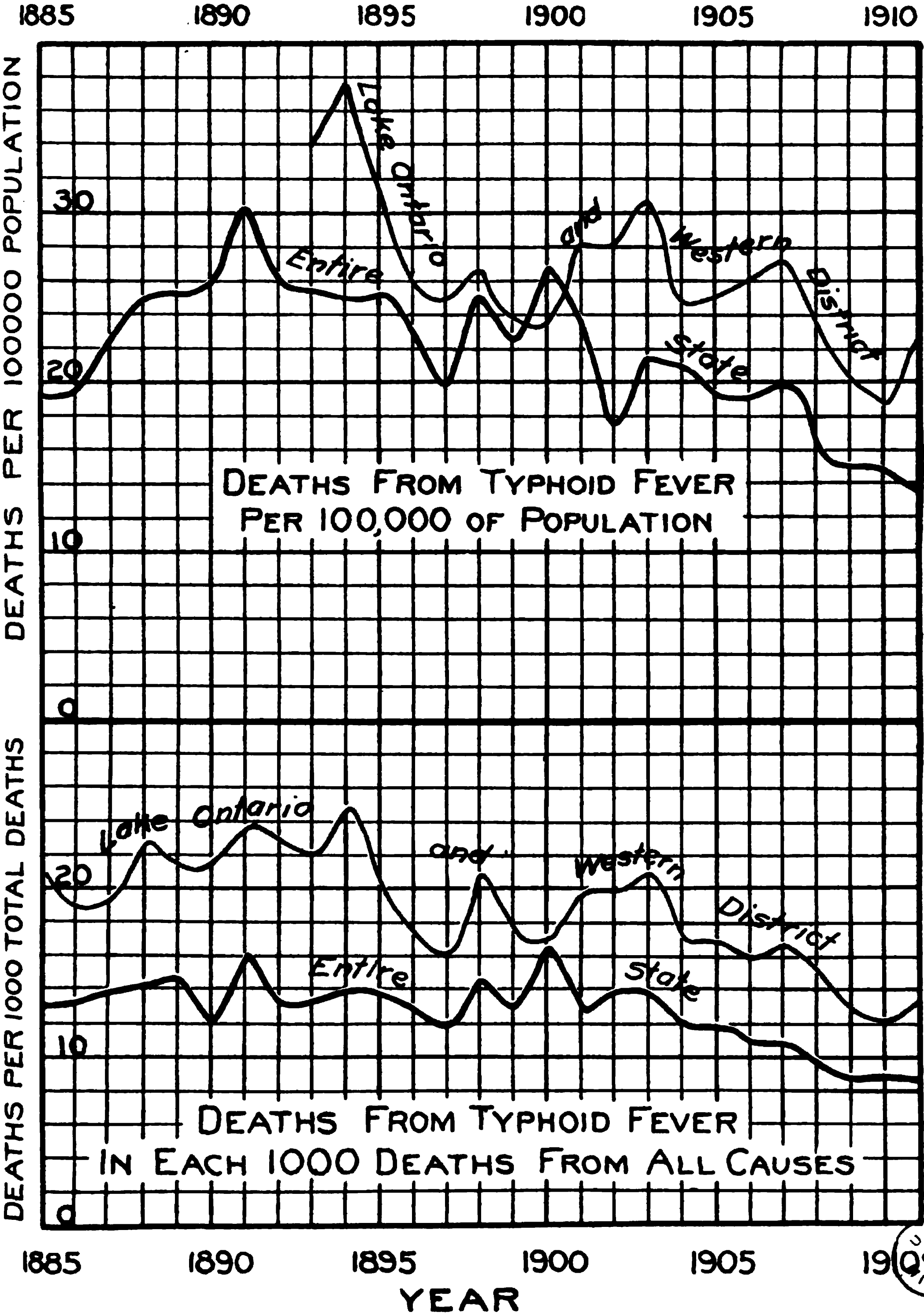
Reference was made to sewerage applications on p. 48. The action taken on various applications is given in appendix E.

ORLEANS WATER SUPPLY PROJECT.

VIEW IN THE HEART OF THE RESERVOIR

Note the perfection of the natural storage. These buildings will all be taken away, the ground will be cleared; all trees, underbrush, debris will be removed. These smiling farms will then be at the bed of a splendid lake nearly two square miles in area.

PLATE XII



The red lines show the deaths from Typhoid Fever from year to year in the region to be supplied from the Linden Reservoir. The blue lines show the deaths in the entire State. Note the continuously bad record of Western New York,

Orleans Water Supply Project.

CONDITIONS ARE ADVERSE TO SECURING ADEQUATE LOCAL SUPPLIES OF PURE AND WHOLESOME WATER.

In the counties of Erie, Niagara, Orleans, Genesee and Monroe, comprising the northwestern section of New York State, natural conditions and their modifications brought about by settlement and cultivation by man, have combined to make it very difficult and costly for the numerous small cities and villages to secure adequate supplies of pure and wholesome water for domestic purposes. The general topography of the country is such that a gravity supply of any kind of water is out of the question for the municipalities acting singly. At the same time the soil and climate unite to make this region the most productive in the State, so that nearly all the land is all cleared and heavily populated. Hence, gathering grounds for a gravity or pumped supply of surface water sufficiently pure for use without filtration do not exist contiguous to the municipalities anywhere in the region.

Supplies from wells are utilized by several of the municipalities, but the region is not an artesian basin and all well supplies are merely local surface waters more or less naturally filtered. Their quality is almost universally bad because of both pollution and hardness. In quantity they are entirely inadequate. Their cost is excessive.

The Niagara river and the Erie canal waters are the only easily available supplies adequate in quantity. The Niagara river supplies the larger cities of the region and the canal is drawn upon more or less frequently in case of shortage by some municipalities. The Niagara river water when filtered under competent supervision can be made reasonable pure and wholesome, but its use in an untreated condition or after treatment under inexpert supervision is pregnant with public peril. Against the use of canal waters there is a public prejudice such that other water can be sold at almost any price in competition with water from the canal whether treated or not. This public prejudice arises from bygone conditions existing along the canal, and it is entitled to respect and sympathy.

In the face of the natural and artificial difficulties set forth

above, the resources of any but the very largest municipality are puny and inadequate, and as a result the municipal water supplies of the region are either entirely inadequate or impure or both.

CONSERVATION COMMISSION BEGINS STUDY SOON AFTER APPOINTMENT.

These conditions challenged the attention of the Conservation Commission very soon after its creation and organization in July, 1911, and active studies of the problems were immediately begun under the authority of sections 21 and 525 of the Conservation Law which provide:

"Sec. 21. *Systematic Plan.* It shall be the duty of the Commission to continue investigations of the water resources of the state including the systematic gaging of rainfall and stream flow throughout the state, so as to complete a comprehensive system for the entire state, for the conservation, development, regulation and use of the waters in each of the principal watersheds of the state with reference to the accomplishment of the following public uses and purposes * * *.

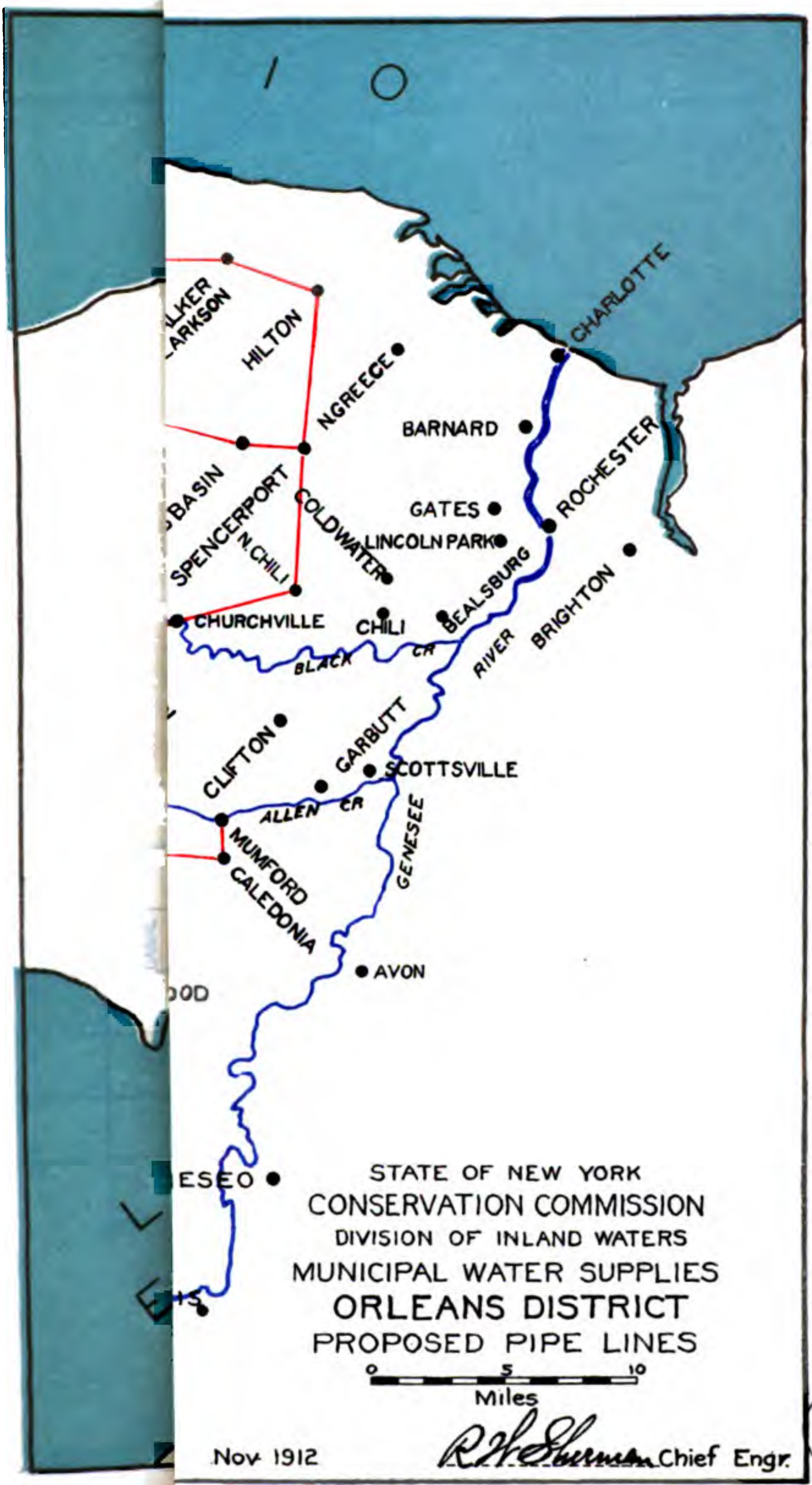
"2. The supply of pure and wholesome water from the watershed to municipalities and the inhabitants thereof."

"Sec. 525. * * * Said Commission shall also report the advisability of, the time required for, and the expenses incident to the construction of a state system of water supply * * * for all or any of the municipal corporations and other civil divisions of the state, and make such recommendations connected with the subjects of said investigations herein provided for as said Commission shall determine."

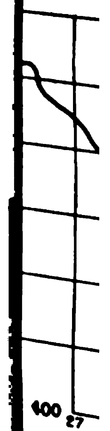
TYPHOID IN THE LAKE ONTARIO AND WESTERN DIVISION OF THE STATE.

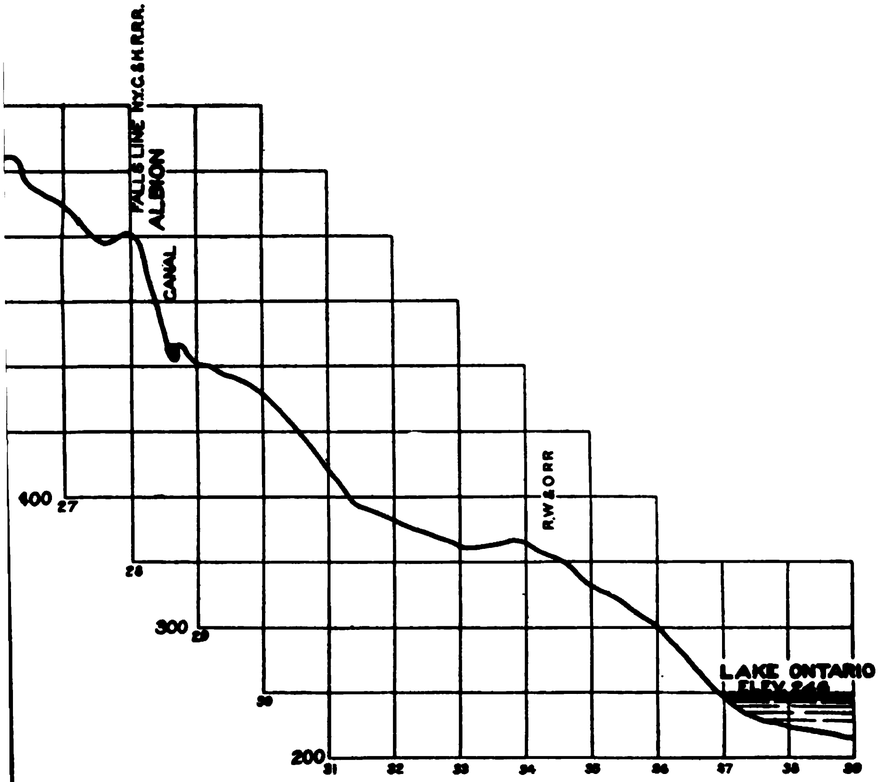
The sections of the State covered by this project corresponds roughly with one of the divisions of the State made by the Board of Health and called by them the Lake Ontario and Western Division. This division has normally a lower death rate than the average for the entire State in the ratio of 11.7 to 16.8, and

PLATE XIII



CHARLOTTE
HILTON
NGREECE
BARNARD
GATES
ROCHESTER
LINCOLN PARK
SPENCERPORT
N. CHILI
COLDWATER
BEALSBURG
BRIGHTON
CHURCHVILLE
CHILI
BLACK CR
RIVER
CLIFTON
GARBUTT
SCOTTSVILLE
ALLEN CR
MUMFORD
CALEDONIA
GENESEE
AVON
STATE OF NEW YORK
CONSERVATION COMMISSION
DIVISION OF INLAND WATERS
MUNICIPAL WATER SUPPLIES
ORLEANS DISTRICT
PROPOSED PIPE LINES
0 5 10
Miles
Nov. 1912
R. W. Sherman Chief Engr.


400
27


FALLS LINE N.Y.C.&H.R.R.R.
ALBION
CANAL
R.W.&O.R.R.
400
300
200
27
28
29
30
31
32
33
34
35
36
37
38
39
LAKE ONTARIO
ELEV. 246

Orleans Water Supply Project.

Site of Linden Dam (*Looking up-stream*)

The straight line shows the crest of the dam. This dam will store up the water from the spring floods of Little Tonawanda Creek which now run wastefully into Niagara River and thence to the sea.

ORLEANS WATER SUPPLY PROJECT.

SITE OF LINDEN DAM (*Looking down-stream*)

This is an ideal location for a dam. The dam will be 650 feet long and 80 feet high. It will rest on solid rock and impound 10,000,000,000 gallons of water. This vast storage will make water famines in this territory a thing of the past.

lower than five of the seven other divisions of the State. As to typhoid fever, however, the showing is the reverse. The district has the undesirable distinction of being the third in the list of districts arranged according to the average death rate from typhoid for the ten year period 1901–1910, and in some of the individual years it jumps into the lead.

On page 191 of the Report of the State Department of Health for the year 1910, we find the following:

In each 1,000 deaths there were from typhoid in the

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Lake Ontario and Western District....	20	20	21	17	17	16	17	15	13	12
Entire State..........	13	14	14	12	12	11	11	10	9	9

The lower drawing of Plate XII shows graphically this same relation for the period 1885–1910. The ratio of typhoid deaths to deaths from all causes is seen to be 50 per cent. greater in this territory than in the State as a whole.

Typhoid is a water borne disease, and the high ratio shown is unquestionably due to the inferior quality and contamination of the water supplies used in this part of the State. Filtration carried out under competent supervision would, of course, partly remedy the situation, but the cost of pumping, filtering and re-pumping where necessary is heavy, and is especially relatively great when the quantity of water is small. The larger cities are able to carry out such enterprises without seriously feeling the burden, but the small municipality finds it very difficult and expensive to secure and pay for the kind of service required to obtain proper results. It is the essence of the scheme herein proposed to secure for all of the municipalities of the region the advantages which can be obtained from operation on a large scale. For each municipality to reach out and secure individually an adequate supply of water of any kind demanded is impracticable financially. By uniting them all on one system, a supply can be secured at a price little if any greater than the cost to each place separately for pumping and filtering alone,

not to mention other costs, even if water otherwise suitable were close at hand.

TONAWANDA AND NORTH TONAWANDA.

Tonawanda and North Tonawanda own their own systems. They use the waters of Niagara river unfiltered. The Niagara river is here charged with the sewage of Buffalo and suburban cities having an aggregate population of about 500,000, the center of which is less than ten miles above Tonawanda. The deaths from typhoid for the ten year period 1901–1910 were 38.3 per one hundred thousand, or from three to four times as many as there would be with water supplies suitable in quality. Though now large, the typhoid death rate will be increased when future public works in the river or change of location of sewer outlets cause new cross currents and produce wave conditions.

NIAGARA FALLS.

Conditions at Niagara Falls were, up to 1912, most deplorable. The typhoid death rate was from 100 to 150 per 100,000 inhabitants, while the rate in cities having proper water supplies is from 9 to 15 per 100,000. The private company supplying the city would not remedy the conditions. The city finally put in a system of its own and now supplies filtered water throughout the city. This will improve the typhoid conditions.

Lockport receives its supply through an eighteen mile pipe line from the Niagara river and uses unfiltered water. The typhoid death rate for the ten year period 1901–1910 was 51.8 per 100,000, or five times the rate prevailing with proper water supplies. This situation needs no comment. Its ghastly significance is apparent on its face.

MEDINA.

Medina has a municipal water works. The supply is pumped from wells along Oak Orchard creek, and is unfiltered.

ALBION.

Albion is supplied by a corporation. The supply is pumped from springs and wells supplemented by water pumped from the

ORLEANS WATER SUPPLY PROJECT,

WEST MIDDLEBURY BAPTIST CHURCH

The water in the reservoir will rise to the level of the "Flow Line" shown on the picture. This will necessitate the removal of the church to higher ground or the construction of a new one at a higher elevation.

Erie canal. The typhoid death rate is about double that in places supplied with pure water.

MIDDLEPORT.

This village contemplates the construction of a new system to be supplied by pumping from well.

HOLLEY.

Holley is supplied by a corporation with water pumped from wells. The supply is unfiltered, and only an intermittent supply is furnished. Conditions are bad.

BROCKPORT.

At Brockport the water supply is by a corporation pumped from springs and wells. The supply is woefully insufficient and present conditions deplorably bad. The municipality is contemplating the construction of its own works at very great cost, by pumping water from Lake Ontario.

SPENCERPORT.

Spencerport pumps its supply from wells.

BATAVIA.

Batavia pumps its supply from Tonawanda creek. The quality of the water is bad, and is not intended for drinking or cooking purposes, or safe for such use. Private wells are principally used for domestic supplies. The typhoid death rate is more than double what it should be.

Table XX gives the foregoing in condensed form.

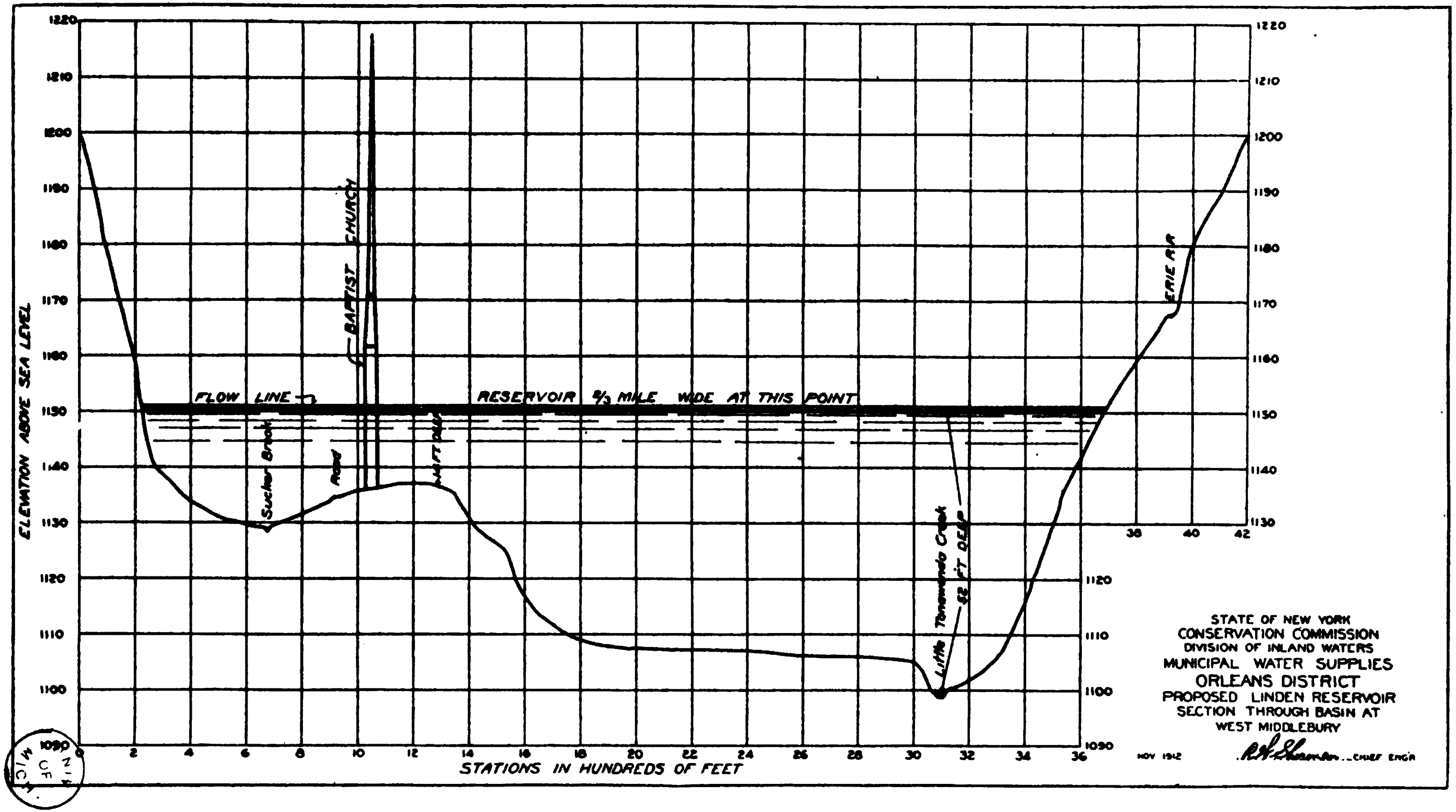
TABLE XX.

TABLE SHOWING PRESENT WATER SUPPLIES TO PRINCIPAL MUNICIPALITIES OF THE ORLEANS WATER SUPPLY DISTRICT.

MUNICIPALITY	Population, 1910	SUPPLY			Typhoid deaths in 1,000 deaths from all causes, 1901–1910	Remarks
		Municipal or corporation	Source	Filtered or raw		
Niagara Falls	30,445	Both	Niagara river	Mechanical filt.	*77.2	
Tonawanda	8,290	Municipal	Niagara river	Raw	25.8	
North Tonawanda	11,955	Municipal	Niagara river	Raw	29.0	
Lockport	17,970	Municipal	Niagara river	Raw	33.0	
Medina	5,683	Municipal	Wells	Raw	3.8	
Albion	5,016	Corporation	Wells; Otter creek canal.	Some filtration	21.5	Application by village pending; supply insufficient except canal.
Middleport	1,530	Municipal	Wells	Raw	....	Under construction.
Holley	1,679	Corporation	Wells	Raw	....	Inadequate supply.
Brockport	3,579	Corporation	Wells	Raw	15.6	Inadequate supply; applicacation by village pending.
Spencerport	1,000	Municipal	Well	Raw	....	
Batavia	11,613	Municipal	Tonawanda creek	Raw	22.6	Bad.
LeRoy	3,771	Municipal	Wells	Raw	12.1	
Average: Lake Ontario and Western Division	1,062,783	....	....	....	16.8	

* Filter recently installed will ultimately reduce this figure.

PLATE XVI


ELEVATION ABOVE SEA LEVEL
STATIONS IN HUNDREDS OF FEET
FLOW LINE
RESERVOIR 2/3 MILE WIDE AT THIS POINT
BAPTIST CHURCH
Road
Sucker Brook
Little Tonawanda Creek
82 FT DEEP
ERIE R.R.
STATE OF NEW YORK
CONSERVATION COMMISSION
DIVISION OF INLAND WATERS
MUNICIPAL WATER SUPPLIES
ORLEANS DISTRICT
PROPOSED LINDEN RESERVOIR
SECTION THROUGH BASIN AT
WEST MIDDLEBURY
NOV 1912
CHIEF ENGR

WATER REQUIREMENTS OF DISTRICT.

The municipalities that may be served by the proposed district are indicated in Table XXI. The populations in 1900, 1905 and 1910 as disclosed by census reports are given, and the population estimated for 1925, allowing the same rate of growth as was shown in the last five year period. This method gives a population of 162,000 in round numbers, to be served in 1925, assuming that all the municipalities take water from the State system. Allowing the usual 100 gallons per day per inhabitant, we should require an ultimate of 16,200,000 gallons per day.

TABLE XXI.

STATISTICS OF POPULATION.

MUNICIPALITY OR VILLAGE	POPULATION			Per cent of change in last five years	Estimate population 1925
	1900	1905	1910		
Lockport	16,581	17,552	17,970	+ 2.39	19,295
Niagara Falls	19,475	26,560	30,445	+14.65	45,820
North Tonawanda	9,069	10,157	11,955	+17.8	19,550
Tonawanda	7,421	7,904	8,290	+ 4.88	9,566
Akron	1,585	1,720	1,677	— 2.56	1,550
Albion	4,477	5,174	5,016	— 3.05	4,565
Barker	....	404	441	+ 9.12	572
Batavia	9,180	10,080	11,613	+15.20	17,756
Bergen	624	601	637	+ 6.30	764
Brockport	3,398	3,627	3,579	— 1.32	3,443
Caledonia	1,073	1,221	1,290	+ 5.65	1,519
Churchville	505	645	565	—12.4	380
Corfu	401	481	413	—14.10	258
Elba	395	404	351	—13.1	230
Holley	1,380	1,506	1,679	+11.5	2,327
Hilton	486	568	627	+ 9.9	832
La Salle	661	1,023	1,299	+27.0	2,869
LeRoy	3,144	3,395	3,771	+11.1	4,476
Lyndonville	....	512	647	+26.4	1,306
Medina	4,716	5,114	5,683	+11.1	7,791
Middleport	1,431	1,358	1,538	+13.3	2,375
Spencerport	715	753	1,000	+32.8	2,342
Miscellaneous small unincorporated villages	....	....	(9,950)	(+ 7.8)	12,467
Total	....	....	120,486	....	161,844

The Proposed Supply from Linden.

To meet the requirements of the district and furnish an adequate supply of pure, clear, soft water, the Conservation Commission proposes to impound the waters of Little Tonawanda creek in a reservoir to be created by the construction of a dam across the creek at Linden. This proposed supply was selected

for investigation after considerable study and reconnaissance. Surveys, underground investigations, stream flow estimates, and plans for filtration and distribution have been prosecuted, and have proceeded to a point where the project is well blocked out and reliable preliminary estimates of cost have been made.

BRIEF DESCRIPTION OF PROPOSED SUPPLY.

The general location of the reservoir with respect to the territory to be served, also the proposed piping system, is shown on Plate XIII, and an elevation or side view of the territory on Plate XIV. A map of the proposed reservoir is given on Plate XV.

The drainage area tributary to the reservoir is 22 square miles. The rock and other hard material are near the surface over this entire area, and the run-off into the reservoir should be a large percentage of the rainfall. In the region along the lower Hudson, where the rainfall is somewhat heavier than in this region (See Map Plate XVII), the run-off from each square mile, if it is all held in reservoirs will supply 10,000 population. The yield of the Linden drainage basin will probably be sufficient to supply from 150,000 to 200,000 people if it is all used, as may be very readily done by the Linden reservoir.

DAM.

The dam site is just above the bridge at Linden. It is particularly favorable. The foundations will be in solid rock. The length is short, and the sides of the ravine steep. The crest of the spillway will be at an elevation of 1,151 feet above sea level, and about 80 feet above the bed of the stream at the site. About ten billion gallons of water will be impounded and 1,150 acres of land flooded.

Some idea of the magnitude of the reservoir can be obtained from the photographs, and the section shown on Plate XVI.

DISTRIBUTION.

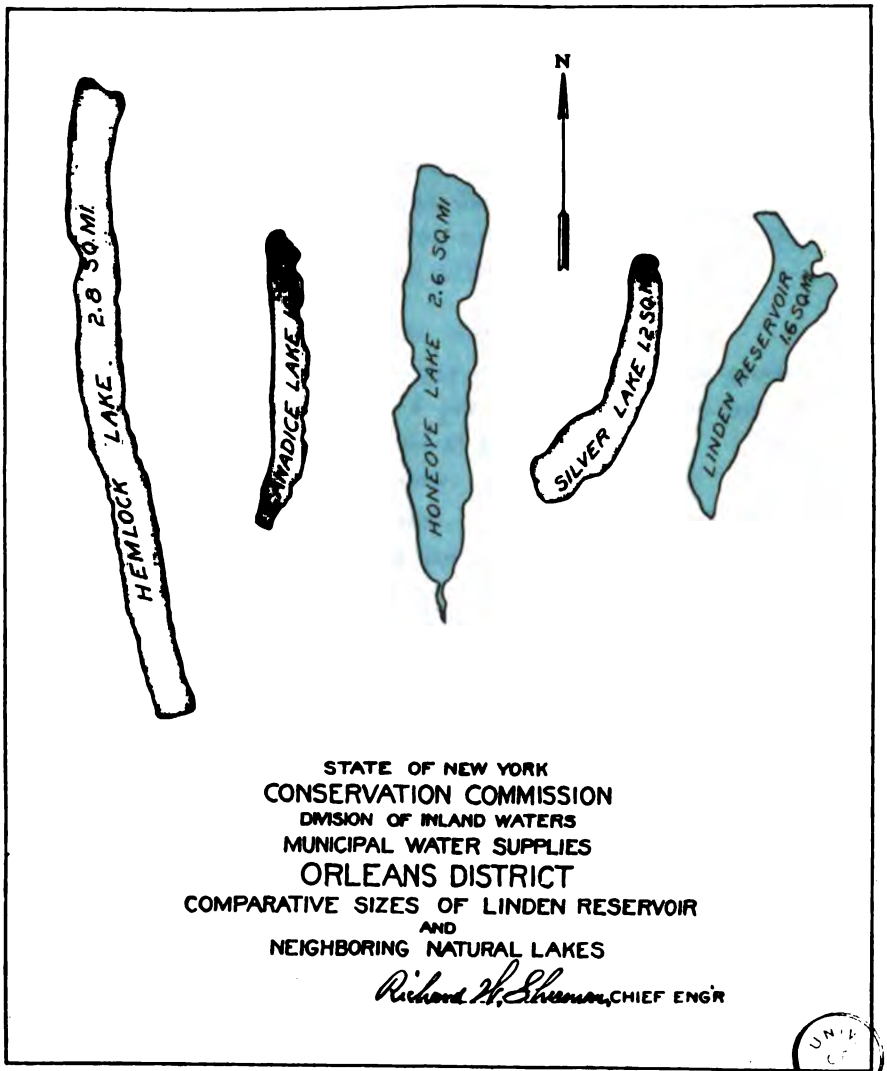
From the reservoir, the water will be passed through filters, and thence will be conveyed to the various municipalities through the piping system shown on Plate XIII.

Orleans Water Supply Project.

Proposed Location of Filter Plant

Filters of the most modern type will make the Linden water, which is naturally exceptionally pure, the finest and most wholesome in the State of New York.

PLATE XVIII


N
HEMLOCK LAKE. 2.8 SQ.MI.
ANADICE LAKE
HONEOYE LAKE 2.6 SQ.MI.
SILVER LAKE 1.2 SQ.M
LINDEN RESERVOIR 1.6 SQ.M
STATE OF NEW YORK
CONSERVATION COMMISSION
DIVISION OF INLAND WATERS
MUNICIPAL WATER SUPPLIES
ORLEANS DISTRICT
COMPARATIVE SIZES OF LINDEN RESERVOIR
AND
NEIGHBORING NATURAL LAKES
Richard H. Sherman, CHIEF ENG'R

The head available is ample, and so much that in some cases it will have to be reduced by pressure regulating valves, before introduction into the systems of the municipalities to be served. The reduction in insurance rates in towns now served with supplies insufficient in quantity or pressure will amount to large sums.

CAPITAL COST OF ORLEANS PROJECT.

The preliminary estimate for the entire cost of the project is $5,000,000 for the reservoir dam, spillway, regulating works, filters, clear water reservoir, land damages, highway relocation and entire piping system, figured to supply to the municipal owned standpipes, a total of 19.0 million gallons daily.

OPERATING COSTS.

Based on State, county or water district bonds, this project could be financed on about a 4 per cent. basis. The cost of operation and repairs is estimated at $25,000 per year.

The total yearly charges become:

Interest 4 per cent. on $5,000,000	$200,000 00
Sinking fund charge (50 yr. 4 per cent.)	32,750 00
Operating costs	25,000 00
Total	$257,750 00

Cost per million gallons =

$$\frac{257,750}{19. \times 365} = \$37.17$$

AVAILABILITY OF LINDEN SUPPLY.

In considering the availability of the Linden supply in comparison with other sources, the following points must be taken into account:

1. The cost to the municipalities of pumping alone ranges from $25 to $75 per million gallons.

2. To filter the water for each place separately under proper supervision would cost the municipality from $5 to $15 per million gallons.

3. For many of the municipalities, sufficient water of proper quality cannot be obtained at a price less than several times the cost by the proposed Linden supply, and for the smaller munic-

ipalities, the price for a suitable supply on the small scale is prohibitive.

4. Pumping expenses are heavy and continue forever, while the cost of the Linden water will be almost nothing at the end of fifty years when the bonds will have been paid.

5. The character of the proposed Linden supply is incomparably superior to all the present supplies in quality, quantity and pressure.

6. The saving in fire losses, and insurance, and in doctors' bills, funeral expenses, loss of time in sickness, or of services in case of death and all the other expenses due to sickness resulting from water borne diseases, must be credited to the Linden supply in making up the comparisons with other supplies, contaminated as we have shown them to be. A further saving of considerable magnitude will result from lessened fuel consumption and boiler repairs in plants using water for manufacturing purposes.

7. Everything considered, the cost of the Linden supply will be much less than the cost of present supplies.

VI. INSPECTION AND SUPERVISION OF HYDRAULIC STRUCTURES.

DAMS IN STREAMS.

Supervision and Inspection.

This subject is covered by Article 3, Section 22, of the Conservation Law, which requires that every owner about to construct a dam shall first submit the proposed plans thereof to the Conservation Commission, and the same provision applies in regard to enlargements, alterations and reconstruction. Before such work can proceed, plans must have the formal approval of the Conservation Commission. The Commission has the power to require the repair or reconstruction of any existing dam, if it deems such work necessary to public safety. The purpose of the law is to so insure the stability, permanency and safety of all dams that their failure (bursting or going out) shall be prevented, and life and property on the streams below made secure.

INSPECTION AND SUPERVISION OF HYDRAULIC STRUCTURES.
MOHAWK WATERSHED.
Failure of timber Dam No. 371 at Fonda.

Inspection and Supervision of Hydraulic Structures.
CHAMPLAIN WATERSHED.
Failure of timber Dam No. 325 at Moffitsville.

Dams outside of a city or village not over 10 feet in height, and where the average high water flow of the stream does not exceed 300 cubic feet per second, are exempted from the provisions of this law.

Failure of Dams.

During the fiscal year twenty-two (22) dams constructed previous to the enactment of the Conservation Law failed (burst or went out) resulting in considerable damage. The following is a list of those which were carefully inspected after their failure.

Timber Dam Failures.

Dam (No. 484 on Black River watershed) at Denley, owned by village of Boonville. A temporary wooden dam 100 feet long, extension of a concrete dam, was carried away on April 16th. There was nothing left of the wooden dam, but the failure was probably due to lack of anchorage.

Dam (No. 325 on Champlain watershed), at Moffitsville, owned by Chateaugay Ore & Iron Company, partly carried away on April 7th because not stone filled. See illustration.

Dam (No. 493 on Champlain watershed), at Wilmington, owned by J. & J. Rogers & Company. The sluiceway was carried out April 7th on account of rotted timber. The timbers of both bulkheads were found in bad condition and ordered rebuilt.

Dam (No. 326 on Upper Hudson watershed), at Broadalbin, owned by Broadalbin Paper Company, had the flume carried away April 9th on account of rotten timbers.

Dam (No. 388 on Upper Hudson watershed), at Glens Falls, owned by International Paper Company. A sixty foot section was carried away in April and a thirty foot section in May, because of insufficient anchorage.

Dam (No. 371 on Mohawk watershed), at Fonda, owned by Streeter Brothers. A section was moved on account of insufficient stone filling. See illustration.

Dam (No. 84 on Central Ontario watershed), at Hannibal Center, owned by Rogers Brothers. Dam was carried away on April 5th.

Dam (No. 289 on Oswegatchie watershed), at Edward, owned by Rushton Estate. The sluiceway was pushed in on April 9th because of rotted timbers.

Dam (No. 265 on Oswegatchie watershed), at Gouverneur, owned by Mrs. Jane Randall and Mrs. Vera Howe. The upper part was carried away on April 9th because not sufficiently filled with stone.

Dam (No. 43 on Susquehanna watershed), at East Waverly, owned by East Waverly Milling Company. A large section was carried away because not sufficiently filled with stone.

Dam (No. 248 on Susquehanna watershed), at Painted Post, owned by Hodgmann Milling Company. A section was lifted and pushed out of line by the ice flow. The dam was built on piles which had rotted, and they had not sufficient stone backing.

Earth Dam Failures.

Dam (No. 639 on Champlain watershed), at Mineville, owned by Witherbee, Sherman & Company. Concrete core gave way April 23d because the rear embankment was washed out by undermining through a porous fine sand foundation bed. See illustration.

Dam (No. 152 on Mohawk watershed), at Schenectady, owned by Delaware & Hudson Railroad Company. Dam was carried away on May 17th on account of undermining along wooden outlet.

Solid Masonry Dam Failures.

Dam (No. 256 on Champlain watershed), at Cadyville, owned by International Paper Company. Bulged on January 15th on account of grouted work and weak mortar.

Dam (No. 563 on Champlain watershed), at Elizabethtown, owned by Lobdell Brothers. Top carried away April 7th because not thick enough.

Dam (No. 594 on Champlain watershed), at Mineville, owned by Daniel F. Payne. Gave way on April 20th because built about two-thirds the necessary thickness to withstand the pressure. See illustration.

Dam (No. 698 on Champlain watershed), at Moriah, owned by Port Henry Light, Heat & Power Company. Gave way April

INSPECTION AND SUPERVISION OF HYDRAULIC STRUCTURES.
CHAMPLAIN WATERSHED.
Failure of earth Dam No. 639 at Mineville.

INSPECTION AND SUPERVISION OF HYDRAULIC STRUCTURES.
CHAMPLAIN WATERSHED.
Failure of masonry Dam No. 594 at Mineville.

9th because of poor quality of sand in the mortar. See illustration.

Dam (No. 567 on Delaware watershed), at Griffin Corners, owned by E. Reynolds. The embankment and core wall were undermined, because the spill was too small.

Dam (No. 609 on Erie watershed), owned by village of Fredonia. Partly carried out on March 30th because wing wall not thick enough. See illustration.

Dam (No. 1005 on Lower Hudson watershed), at Shandaken, owned by Ada Van Zandt. Was partly carried away on account of too thin walls.

Dam (No. 260 on Upper Hudson watershed), at Greenwich, owned by J. V. Palmer Company. The top was carried away on March 22d on account of laitance. See illustration.

Dam (No. 360 on Oswego watershed), at Auburn, owned by F. E. Parker and Henry & Allen. Carried away on April 5th because of poor mortar.

A number of small dams not included above have gone out in different parts of the State, a few of which may not have come to the attention of the Commission. Possibly all of them were less than 10 feet high and did not come under the provisions of the Conservation Law.

Plans of Dams Approved.

During the fiscal year plans for the construction or reconstruction of sixty-four (64) dams have been examined and approved. The number, the watershed, the nearest town, and the owner, are given below for each of such dams:

No.	Watershed	Location	Owner
17	Black	Watertown	Dexter Sulphite Paper Co.
83	Black	Watertown	New York Air Brake Co.
86	Black	Watertown	Bagley & Sewall Co.
106	Black	Watertown	City of Watertown.
229	Black	Carthage	Island Paper Co.
231	Black	Carthage	Carthage Electric Light & Power and others.
478	Black	Port Leyden	Town of Port Leyden.
484	Black	Denley	Town of Boonville.
236	Champlain	Morrisonville	City of Plattsburgh.
256	Champlain	Cadyville	International Paper Co.

No.	Watershed	Location	Owner
563	Champlain........	Elizabethtown...	Lobdell Bros.
568	Champlain........	Elizabethtown...	Elizabethtown Electric Plant.
594	Champlain........	Mineville	Daniel F. Payne.
661	Champlain........	St. Huberts....	Adirondack Mountain Reserve.
693	Champlain........	Port Henry....	Port Henry Light, Heat & Power Co.
698	Champlain........	Port Henry....	Port Henry Light, Heat & Power Co.
110	Delaware..........	Hartwood	Hartwood Club.
288	Delaware..........	Kenoza Lake...	Fred A. Hust.
558	Delaware..........	Griffin Corners..	Charles A. Vermilya.
557	Delaware..........	Griffin Corners..	Elsworth Reynolds.
646	Delaware..........	Roxbury	Helen Gould.
475	Erie	Batavia	Town of Batavia.
555	Erie	Gowanda	Keyes Electric Co.
55	Genesee	Rochester	Rochester Railway & Light Co.
65	Genesee	Rochester	Rochester Railway & Light Co.
326	Genesee	Hemlock	City of Rochester.
422	Genesee	Perry	Silver Lake Milling Co.
408	Lower Hudson....	Southfield	Schuyler Schieffelin.
443	Lower Hudson.....	Central Valley..	F. F. Proctor.
465	Lower Hudson.....	Highland Mills.	City of Peekskill.
498	Lower Hudson.....	Peekskill	Commonwealth Water Co.
506	Lower Hudson.....	Firthcliffe	Firth Carpet Co.
555	Lower Hudson.....	Glenham	Glenham Embroidery Co.
964	Lower Hudson.....	Phoenicia	Woodland School.
969	Lower Hudson.....	Baker Mills....	Red Hook Light & Power Co.
1005	Lower Hudson.....	Shandaken	Ada Van Zandt.
1059	Lower Hudson.....	Hillsdale	Quincy Johnson.
1407	Lower Hudson.....	Watervliet	Storm Sewer Commission.
1412	Lower Hudson.....	Watervliet	Storm Sewer Commission.
1413	Lower Hudson.....	Watervliet	Storm Sewer Commission.
1430	Lower Hudson....	Grafton	City of Troy.
260	Upper Hudson....	Greenwich	Jesse V. Palmer Co.
265	Upper Hudson....	Clark's Mills...	American Wood Board Co.
360	Upper Hudson....	Corinth	Warren Curtis, Jr.
388	Upper Hudson....	Glens Falls.....	International Paper Co.
608	Upper Hudson....	Oregon	Richard Hudnut.
336	Mohawk	Middleburgh ...	Middleburgh & Schoharie Light, Heat & Power Co.
389	Mohawk	Brooksburg	Thomas M. St. John.
477	Mohawk	Canada Lake...	Duray Land & Lumber Co.
486	Mohawk	Prattsville	Devasego Power Development Co.
505	Mohawk	Green Lake.....	Duray Land & Lumber Co.
506	Mohawk	Green Lake.....	Duray Land & Lumber Co.
814	Mohawk	Trenton Falls...	James H. Glass.
270	West Ontario.....	Newfane	Frederick K. Wing Co.
355	Oswegtachie	Antwerp	Village of Antwerp.
360	Oswego	Auburn	Henry & Allen–F. E. Parker.

Inspection and Supervision of Hydraulic Structures.
Champlain Watershed.
Failure of masonry Dam No. 698 at Moriah.

INSPECTION AND SUPERVISION OF HYDRAULIC STRUCTURES.
ERIE WATERSHED.
Failure of masonry Dam No. 609 at Fredonia.

INSPECTION AND SUPERVISION OF HYDRAULIC STRUCTURES.
UPPER HUDSON WATERSHED.
Failure of masonry Dam No. 260 at Greenwich.

INSPECTION AND SUPERVISION OF HYDRAULIC STRUCTURES.
ERIE WATERSHED.
Failure of dock at Eagle Park, Grand Island, Buffalo.

No.	Watershed	Location	Owner
545	Oswego	Locke	Village of Locke.
142	Salmon	Altmar	Salmon River Power Development Co.
12	E. St. Lawrence...	Fort Covington..	Fort Covington Light, Heat & Power Co.
61	St. Regis.........	Helena	Hugh Raymond.
219	St. Regis.........	St. Regis Falls.	St. Regis Light & Power Co.
43	Susquehanna	E. Waverly.....	East Waverly Milling Co.
293	Susquehanna	Binghamton	A. J. Lyons & Sons.
661	Susquehanna	Hornell	Pranger Bros.

Orders Relating to Existing Dams.

Sixty-five dams have been inspected and ordered strengthened or improved. The number, the watershed, the nearest town and the owner are given below for each of these dams:

484	Black	Denley	Town of Boonville.
544	Black	McKeever	Iroquois Pulp & Paper Co.
568	Black	Fulton Chain...	Brown Tract Lumber Co.
237	Champlain	Plattsburgh	City of Plattsburgh.
670	Champlain	Port Henry.....	Port Henry Light, Heat & Power Co.
692	Champlain	Moriah	Port Henry Light, Heat & Power Co.
73	Delaware	Sparrow Bush..	Henry Furberg.
126	Delaware	Hartwood	Willis Butler.
168	Delaware	Wurtsboro	Yankee Lake Company.
170	Delaware	Wurtsboro	Wolf Pond.
193	Delaware	Wurtsboro	McKee Pond.
195	Delaware	Wurtsboro	Thomas Watts.
226	Delaware	Stevensville	Alden S. Swan
231	Delaware	Wurtsboro	Falsburgh Fishing & Boating Club.
388	Erie	Orchard Park...	Harry Yates.
609	Erie	Fredonia	Village of Fredonia.
76	Grasse	Massena	Dr. F. A. Anderson and others
219	Lower Hudson....	Tappen	David Brower.
267	Lower Hudson....	Nyack	John C. Klein.
268	Lower Hudson....	Nyack	Smith Leydecker.
272	Lower Hudson....	Nyack	John L. Felton.
276	Lower Hudson....	Nyack	J. B. Garrabrant.
290	Lower Hudson....	Congers	Conger Board of Trade.
302	Lower Hudson....	New City.......	C. McDougall.
313	Lower Hudson....	Sterlington	Ramapo Mfg. Co.
523	Lower Hudson....	Matteawan	Town.
537	Lower Hudson....	Matteawan	Town.
538	Lower Hudson....	Tuxedo	Tuxedo Park Association.
585	Lower Hudson....	Montgomery ...	Townsend Bull Estate.
710	Lower Hudson....	Poughkeepsie ...	State Hospital.

No.	Watershed	Location	Owner
1009	Lower Hudson....	Hudson	City of Hudson.
1011	Lower Hudson....	Shandaken	Mountain School.
1016	Lower Hudson....	Shandaken	Ann Curtair.
1408	Lower Hudson....	Pine Hill.......	Pine Hill Lake Co.
1420	Lower Hudson....	Berlin	Marshall Estate.
126	Upper Hudson.....	Willow Glen....	Edward Farrell.
326	Upper Hudson.....	Broadalbin	Broadalbin Paper Mfg. Co.
627	Upper Hudson.....	Chestertown	Mrs. John B. Haskins.
636	Upper Hudson.....	Chestertown	William H. Faxon.
641	Upper Hudson.....	Chestertown	William H. Faxon.
643	Upper Hudson.....	Chestertown	William H. Faxon.
148	Mohawk	Schenectady	Joseph Gritzback.
224	Mohawk	Mariaville	Mary B. Walpole.
410	Mohawk	Cobleskill	Sheffield Farms.
455	Mohawk	Garoga	Lyman Everitt.
456	Mohawk	Garoga	Mohawk Hydro Electric Co.
466	Mohawk	Richmondville ..	Julius Davenport.
65	Central Ontario ..	Hannibal	John McFalland.
84	Central Ontario ..	Hannibal Center	Rogers Bros.
204	Central Ontario ..	Wolcott	G. W. Rice.
253	Oswegatchie	Natural Dam...	Aldrich Paper Co.
265	Oswegatchie	Gouverneur	Jane Randall.
289	Oswegatchie	Edwards	Ann Rushton Estate.
370	Oswegatchie	Oswegatchie	Carthage Sulphite Pulp & Paper Co.
408	Oswegatchie	Oswegatchie	Oswegatchie Grist Mill.
409	Oswegatchie	Newton Falls...	Newton Falls Paper Co.
410	Oswegatchie	Newton Falls...	Newton Falls Paper Co.
358	Oswego	Auburn	Canoga Woolen Co.
219	St. Regis.........	St. Regis Falls..	St. Regis Heat & Power Co.
248	Susquehanna	Painted Post...	Hodgmann Milling Co.
604	Susquehanna	Norwich	Bushley & White.
646	Susquehanna	Hornell	City of Hornell.
1010	Susquehanna	East Worcester.	W. F. Schupe.
1026	Susquehanna	East Worcester.	W. F. Schupe.
1029	Susquehanna	East Worcester.	W. F. Schupe.

All of the dams of the State, which are very numerous, are being inspected, and descriptions and data pertaining to them placed in the files of the Albany office of the Commission as rapidly as possible, and at some time in the not distant future such records will have been made quite complete. As a result of the supervision and inspection under the Conservation Commission, it may be confidently expected that the number of failures of dams and the loss of life and property resulting therefrom will rapidly decrease, and that within a few years the failure of dams in this State will almost cease.

APPENDIX A

KENNEDY & HATCH LEASE FOR THE SURPLUS WATERS AT LOCKPORT.

of the canal, shall render such limitation, control or resumption necessary; and it is further agreed, that if at any time, the rent hereby reserved shall remain unpaid for one year, after the same shall become due, that this lease shall be forfeited to the State; and the said Commissioners may, thereupon, relet the said surplus waters to any other person in like manner, as if no lease hereof had been executed.

In witness whereof, the parties to these presents have hereunto set their hands and seals, the day and date above written. Signed, sealed and delivered, in presence of

R. KENNEDY [L. S.]

Witness to the execution of this
by Richard Kennedy.
GEORGE W. YOUNG.

JUNIUS H. HATCH. [L. S.]

Witness to the execution of
Junius H. Hatch.
JOHN A. EHLE.

SAMUEL YOUNG. [L. S.]
HENRY SEYMOUR. [L. S.]
WM. C. BOUCK. [L. S.]

A contract is the result of the meeting of minds, and the interpreting of a contract must rest upon an endeavor to comprehend the environments of those making the contract and thus comprehend what were the considerations offered by each party. Examining this contract in the light of this principle, it will be apparent that the consideration for which Messrs. Kennedy and Hatch agreed to pay $200 per year was the average amount of water that would flow around the locks of the canal *as it then existed.*

The canal had just been constructed (completed at the western end in preceding fall) and it was the last word in transportation. Nobody then expected that it would ever be necessary to change it. Forty years of adverse possession would not prevent suit for recovery of excess over the amount originally contracted for because of (2) of section 362 of the code.

APPENDIX B

EXTRACTS FROM REPORT OF INTERNATIONAL WATERWAYS COMMISSION.

APPENDIX B

EXTRACTS FROM REPORT OF INTERNATIONAL WATERWAYS COMMISSION DATED MARCH 19, 1906.

Extracts from report of International Waterways Commission dated March 19, 1906.

The total quantity of water to be taken from the river by works now authorized is:

	Cubic Feet
Niagara Falls Hydraulic Power & Manufacturing Co..	9,500
Niagara Falls Power Company....................	17,200
Canadian Niagara Power Company	9,500
Ontario Power Company, not including Welland River Development	12,000
Electrical Development Company	11,200
Niagara Falls Park Railway Co....................	1,500
Total	60,900

Of this amount 26,700 cubic feet is to be taken on the American side and the remainder, 34.200 cubic feet, on the Canadian side. That is, 27 per cent. of the average discharge and 33 per cent. of the low water discharge of the Niagara river will cease to pass over the falls when these works are completed and in full operation. The quantity to be diverted is more than double the quantity which now passes over the American Fall, which at the average stage is about 27,800 cubic feet. That this will in general have an injurious effect upon the falls seems self-evident. The volume of water to be diverted is about the equivalent of the entire discharge of Lake Superior over the Sault Ste. Marie. The amount thus far actually diverted is but 17,800 cubic feet per second, and has had an appreciable effect upon the falls. To fortell with accuracy the effects in detail of the full diversion authorized

would require a more complete knowledge of the bed of the river than is now obtainable. The water taken on the Canadian side below the crest of the rapids will affect the Horseshoe Falls alone. If all that taken on the American side should affect the American Fall alone, it would practically leave it dry; but it seems probable that only a part of this diversion will be at the expense of the American Fall.

Exactly what portion that will be can not be stated with precision, but from a study of the channels and reefs, so far as they are known, a reasonable estimate is that the water would come from the two arms in about the proportion of one-sixth from the American Fall and five-sixths from the Horseshoe Fall. Exactly what form the changes in the two cataracts will take, whether they will be made narrower, or be broken up into a greater number of streams, or simply be reduced in volume, retaining in general their present form, cannot now be foretold, for the reason that there is no accurate knowledge of the form of and depth of water on the crests. If 60,900 cubic feet per second be diverted, the loss will be important, but if the diversion be limited to this amount, or reduced, as hereafter indicated, it may not prove disastrous. This cannot be definitely determined until the works now under construction have been completed and put in operation. When that happens, if it be found that the falls have not suffered serious damage, as a scenic spectacle, it does not follow that additional water may be diverted with impunity. Additional diversion would be an experiment even more dangerous than that now being tried, and in our opinion should not be permitted.

In return for the impairment of the falls thus far authorized the State of New York will receive practically nothing for the 342,000 horsepower authorized on that side, and the Queen Victoria Niagara Falls Park will receive an annual rental of $270,-000, or an average of 65 cents per horsepower for the 415,000 horsepower authorized on the Canadian side. These figures do not include the 8,000 horsepower being developed by the electrical railway nor the power developed by the Hamilton Company with water from the Welland canal.

If all the water and all the head from the top of the upper rapids to the foot of the falls could be utilized, there would result over 4,000,000 mechanical horsepower. Probably space could be

found, if desired, for works which would utilize about half of this, or, say, 2,000,000 horsepower, or possibly more. As they could not utilize all the head, they would use much more than half the water. It will require time to create a market for all this power but it is reasonably certain that it will in due season be found if the development of the power itself is to go on unchecked. The difference in cost in favor of falling water over any other method of developing power is so great that all other methods are sure to be abandoned where sufficient water power is available. The difference at Niagara Falls is probably not less than $15 or $20 per annum per horsepower. The cost of transmission to distant points increases with the distance, and finally becomes so great as to be unprofitable; but electrical engineers are engaged in improving the methods and reducing the cost. An average difference of cost for each horsepower cannot now be given with any close degree of approximation, but the difference, whatever it is, is a perpetual annual saving, which, if capitalized, will show that the commercial value of the power at Niagara Falls is very great and is to be measured by the hundred millions of dollars.

Whether this commercial asset shall be utilized to such an extent as to seriously impair the majesty and scenic beauty of the falls depends upon the public will. In our opinion the commercial advantages of a large increase in development of power will not compensate for the great loss to the world of the inspiration, aesthetic education, and opportunity for recreation and elevating pleasure which the mighty cataract affords. The direct advantages to the public from revenue is nothing on the New York side of the river, and comparatively slight on the Canadian side. There is of course an indirect advantage due to added taxable wealth and reduction in the cost of power, but these advantages are, in our opinion, slight in comparison with those which spring from the preservation of the beauty and majesty of the falls in their natural condition. Over 800,000 people visit the falls annually, deriving pleasure and inspiration from them. The nations of the world have always recognized the great value of parks and reservations, and throughout the civilized world they have preserved places of natural grandeur and beauty and furnished parks, artificially beautified, for rest, education, and the elevation of their people. An illustration may be given in the

case of the city of New York, one of many hundreds. There the municipality has acquired, in Central Park, property which is estimated to be worth $225,000,000, and has spent millions upon its improvement and ornamentation. The United States Government has preserved lands of striking picturesqueness, grandeur, and interest, regardless of their value. These illustrations would seem to prove conclusivxely that the people are not inclined to offset mere commercial values against the intangible but non the less great advantages found in the preservation of the great works of nature.

It is probably not expedient to attempt the recovery of the rights granted to companies which have taken full advantage of them. In the case of the Niagara Falls Power Company, on the American side, the franchise authorizes it to develop 200,000 horsepower. It has constructed works having about half that capacity, but has not begun the construction of the additional works, and we believe has no present intention of doing so. In the case of the Ontario Power Company, on the Canadian side, the construction of works under the agreement of April 11, 1900, has been indefinitely postponed. The authority for the additional works in both these cases could probably be withdrawn without inflicting an unreasonable hardship. All franchise of which advantage has not been taken should be extinguished.

The following is a summary of the foregoing statement of facts:

(a) The glory of Niagara Falls lies in the volume of its water rather than in its height, or in the surrounding scenery.

(b) Works are now authorized and partially completed at the falls which will divert from the Niagara river above the falls about 27 per cent. of the average discharge, and about 33 per cent. of the low water discharge, which is more than double the quantity now flowing over the American Fall. In addition to this, water naturally tributary to the Niagara river is being diverted through the Chicago drainage canal, and for power in addition to navigation purposes through the Erie and the Welland canals.

(c) The effect of this withdrawal of water is to injure both the American and the Horeshoe falls in nearly equal proportions. While the injury will be perceptible, it may not be destructive or disastrous.

(d) Improvements in the transmission of electric power and increased demand will make a market for all the power which can be developed at Niagara Falls, and will cause a destruction of the falls as a scenic spectacle if the development be allowed to go on unchecked.

(e) Charters have been granted to corporations which propose to divert additional amounts in quantities not now limited.

(f) The sums of money invested, or being invested, in the works now in operation or under construction, and in the industries dependent upon them, amount to many millions of dollars. It is probably not expedient to attempt the withdrawal of the rights thus utilized.

(g) The commercial value of the water power at Niagara Falls is very great, but if compared with values set aside by wealthy communities elsewhere for park purposes this value is not too great to be devoted to similar purposes. The place is visited annually by about 800,000 people.

If the falls are to be preserved it must be by mutual agreement between the two countries. As a step in that direction we recommend that legislation be enacted which shall contain the following provisions, viz.:

(a) The Secretary of War to be authorized to grant permits for the diversion of 28,500 cubic feet per second, and no more, from the waters naturally tributary to Niagara Falls, distributed as follows:

	Cubic feet
Niagara Falls Hydraulic Power & Mfg. Co.	9,500
Niagara Falls Power Company	8,600
Erie canal or its tenants (in addition to lock service)	500
Chicago drainage canal	10,000

(b) All other diversion of water which is naturally tributary to Niagara Falls to be prohibited, except such as may be required for domestic use or for the service of locks in navigation canals.

(c) Suitable penalties for violation of the law to be prescribed.

(d) The foregoing prohibition to remain in force for two years, and then to become the permanent law of the land, if, in the meantime, the Canadian government shall have enacted legislation prohibiting the diversion of water which is naturally tributary to Niagara Falls, in excess of 36,000 cubic feet per second, not in-

cluding the amounts required for domestic use or for the service of locks in navigation canals. It is assumed, however, that an understanding upon this subject would be reached by treaty.

The object of such legislation would be to put a stop to the further depletion of the falls, and at the same time inflict the least possible injury upon the important interests now dependent upon this water power. The amount to be diverted on the Canadian side has been fixed with a view to allowing to the companies on that side the amounts for which they now have works under construction, which are:

	Cubic feet
Canadian Niagara Power Company	9,500
Ontario Power Company	12,000
Electrical Development Company	11,200
Niagara Falls Park Railway Company	1,500
Welland canal or its tenants (in addition to lock service)	1,800

One of the effects of such legislation would be to give to Canada the advantage of diverting 7,500 cubic feet per second more than is diverted in the United States. The advantage is more apparent than real, since the power generated on the Canadian side will to a large extent be transmitted to and used in the United States. In the negotiation of a treaty however, the point should be considered.

The substance of this report was submitted to our Canadian colleagues before the passage of the joint resolution, with a view to uniting in a joint report under the general law providing for the Commission. There was a substantial agreement in the statement of facts, and such differences as developed with respect to the recommendations which ought to be made did not seem insuperable, but our colleagues desired time for further consideration. We have no doubt of their sympathetic interest in carrying out that part of the instructions contained in the resolution which required us "to exert in conjunction with the members of said Commission representing the Dominion of Canada, if practicable, all possible efforts for the preservation of Niagara Falls in their natural condition."

APPENDIX C

TREATY BETWEEN THE UNITED STATES AND GREAT BRITAIN—BOUNDARY WATERS BETWEEN THE UNITED STATES AND CANADA.

APPENDIX C

TREATY BETWEEN THE UNITED STATES AND GREAT BRITAIN—BOUNDARY WATERS BETWEEN THE UNITED STATES AND CANADA.

Treaty Series No. 548 — Treaty between the United States and Great Britain — Boundary Waters between the United States and Canada.

Signed at Washington January 11, 1909.

Ratification advised by the Senate March 3, 1909.

Ratified by the President April 1, 1910.

Ratified by Great Britain March 31, 1910.

Ratifications exchanged at Washington May 5, 1910.

Proclaimed May 13, 1910.

By the President of the United States of America.

A Proclamation.

Whereas a treaty between the United States of America and His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British dominions beyond the seas, Emperor of India, to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise, was concluded and signed by their respective plenipotentiaries at Washington on the eleventh day of January, one thousand nine hundred and nine, the original of which treaty is, word for word, as follows:

The United States of America and His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British dominions beyond the seas, Emperor of India, being equally desirous to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the

rights, obligations, or interests of either in relation to the other or to the inhabitants of the other along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise, have resolved to conclude a treaty in furtherance of these ends, and for that purpose have appointed as their respective plenipotentiaries:

The President of the United States of America, Elihu Root, Secretary of State of the United States; and

His Brittanic Majesty, the Right Honorable James Bryce, O. M., his ambassador, extraordinary and plenipotentiary at Washington.

Who, after having communicated to one another their full powers, found in good and due form, have agreed upon the following articles:

PRELIMINARY ARTICLE.

For the purpose of this treaty boundary waters are defined as the waters from main shore to main shore of the lakes and rivers and connecting waterways or the portions thereof, along which the international boundary between the United States and the Dominion of Canada passes, including all bays, arms and inlets thereof, but not including tributary waters which in their natural channels would flow into such lakes, rivers, and waterways or waters flowing from such lakes, rivers and waterways, or the waters of rivers flowing across the boundary.

ARTICLE I.

The high contracting parties agree that the navigation of all navigable boundary waters shall forever continue free and open for the purposes of commerce to the inhabitants and to the ships, vessels, and boats of both countries equally, subject, however, to any laws and regulations of either country, within its own territory, not inconsistent with such privilege of free navigation and applying equally and without discrimination to the inhabitants, ships, vessels and boats of both countries.

It is further agreed that so long as this treaty shall remain in force this same right of navigation shall extend to the waters of Lake Michigan and to all canals connecting boundary waters and

now existing or which may hereafter be constructed on either side of the line. Either of the high contracting parties may adopt rules and regulations governing the use of such canals within its own territory and may charge tolls for the use thereof, but all such rules and regulations and all tolls charged shall apply alike to the subjects or citizens of the high contracting parties and the ships, vessels, and boats of both of the high contracting parties, and they shall be placed on terms of equality in the use thereof.

ARTICLE II.

Each of the high contracting parties reserves to itself or to the several State Governments on the one side and the Dominion or Provincial Governments on the other, as the case may be, subject to any treaty provisions now existing with respect thereto, the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters; but it is agreed that any interference with or diversion from their natural channel of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs; but this provision shall not apply to cases already existing or to cases expressly covered by special agreement between the parties hereto.

It is understood, however, that neither of the high contracting parties intends by the foregoing provision to surrender any right which it may have to object to any interference with or diversion of waters on the other side of the boundary the effect of which would be productive of material injury to the navigation interests on its own side of the boundary.

ARTICLE III.

It is agreed that, in addition to the uses, obstructions, and diversions heretofore permitted or hereafter provided for by special agreement between the parties hereto, no further or other uses or obstructions or diversions, whether temporary or perma-

nent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions and with the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission.

The foregoing provisions are not intended to limit or interfere with the existing rights of the Government of the United States on the one side and the Government of the Dominion of Canada on the other, to undertake and carry on governmental works in boundary waters for the deepening of channels, the construction of breakwaters, the improvement of harbors, and other governmental works for the benefit of commerce and navigation, provided that such works are wholly on its own side of the line and do not materially affect the level or flow of the boundary waters on the other, nor are such provisions intended to interfere with the ordinary use of such waters for domestic and sanitary purposes.

ARTICLE IV.

The high contracting parties agree that, except in cases provided for by special agreement between them, they will not permit the construction or maintenance on their respective sides of the boundary of any remedial or protective works or any dams or other obstructions in waters flowing from boundary waters or in waters at a lower level than the boundary in rivers flowing across the boundary, the effect of which is to raise the natural level of waters on the other side of the boundary unless the construction or maintenance thereof is approved by the aforesaid International Joint Commission.

It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other.

ARTICLE V.

The high contracting parties agree that it is expedient to limit the diversion of waters from the Niagara river so that the level of Lake Erie and the flow of the stream shall not be appreciably

affected. It is the desire of both parties to accomplish this object with the least possible injury to investments which have already been made in the construction of power plants on the United States side of the river under grants of authority from the State of New York, and on the Canadian side of the river under licenses authorized by the Dominion of Canada and the Province of Ontario.

So long as this treaty shall remain in force no diversion of the waters of the Niagara river above the falls from the natural course and stream thereof shall be permitted except for the purposes and to the extent hereinafter provided.

The United States may authorize and permit the diversion within the State of New York of the waters of said river above the Falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of twenty thousand cubic feet of water per second.

The United Kingdom, by the Dominion of Canada, or the Province of Ontario, may authorize and permit the diversion within the Province of Ontario of the waters of said river above the Falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of thirty-six thousand cubic feet of water per second.

The prohibitions of this article shall not apply to the diversion of water for sanitary or domestic purposes, or for the service of canals for the purposes of navigation.

ARTICLE VI.

The high contracting parties agree that the St. Mary and Milk rivers and their tributaries (in the State of Montana and the Provinces of Alberta and Saskatchewan) are to be treated as one stream for the purposes of irrigation and power, and the waters thereof shall be apportioned equally between the two countries, but in making such equal apportionment, more than half may be taken from one river and less than half from the other by either country so as to afford a more beneficial use to each. It is further agreed that in the division of such waters during the irrigation season, between the 1st of April and 31st of October, inclusive, annually, the United States is entitled to a prior appropriation of

500 cubic feet per second of the waters of the Milk river, or so much of such amount as constitutes three-fourths of its natural flow, and that Canada is entitled to a prior appropriation of 500 cubic feet per second of the flow of St. Mary river, or so much of such amount as constitutes three-fourths of its natural flow.

The channel of the Milk river in Canada may be used at the convience of the United States for the conveyance, while passing through Canadian territory, of waters diverted from the St. Mary river. The provisions of article II of this treaty shall apply to any injury resulting to property in Canada from the conveyance of such waters through the Milk river

The measurement and apportionment of the water to be used by each country shall from time to time be made jointly by the properly constituted reclamation officers of the United States and the properly constituted irrigation officers of His Majesty under the direction of the International Joint Commission.

ARTICLE VII.

The high contracting parties agree to establish and maintain an International Joint Commission of the United States and Canada composed of six commissioners, three on the part of the United States appointed by the President thereof, and three on the part of the United Kingdom appointed by His Majesty on the recommendation of the Governor in Council of the Dominion of Canada.

ARTICLE VIII.

This International Joint Commission shall have jurisdiction over and shall pass upon all cases involving the use or obstruction or diversion of the waters with respect to which, under articles III and IV of this treaty, the approval of this commission is required, and in passing upon such cases the commission shall be governed by the following rules or principles which are adopted by the high contracting parties for this purpose:

The high contracting parties shall have, each on its own side of the boundary, equal and similar rights in the use of the waters hereinbefore defined as boundary waters.

The following order of precedence shall be observed among the

various uses enumerated hereinafter for these waters and no use shall be permitted which tends materially to conflict with or restrain any other use which is given preference over it in this order of precedence:

(1) Uses for domestic and sanitary purposes;

(2) Uses for navigation, including the service of canals for the purpose of navigation;

(3) Uses for power and for irrigation purposes.

The foregoing provisions shall not apply to or disturb any existing uses of boundary waters on either side of the boundary.

The requirement for an equal division may, in the discretion of the commission, be suspended in cases of temporary diversions along boundary waters at points where such equal division cannot be made advantageously on account of local conditions and where such diversion does not diminish elsewhere the amount available for use on the other side.

The commission in its discretion may take its approval in any case conditional upon the construction of remedial or protective works to compensate so far as possible for the particular use or diversion proposed, and in such cases may require that suitable and adequate provision, approved by the commission, be made for the protection and indemnity against injury of any interests on either side of the boundary.

In cases involving the elevation of the natural level of waters on either side of the line as a result of the construction or maintenance on the other side of remedial or protective works or dams or other obstructions in boundary waters or in waters flowing therefrom or in waters below the boundary in rivers flowing across the boundary, the commission shall require, as a condition of its approval thereof, that suitable and adequate provision, approved by it, be made for the protection and indemnity of all interests on the other side of the line which may injured thereby. interests on the other side of the line which may be injured thereby.

The majority of the commissioners shall have power to render a decision. In case the commission is evenly divided upon any question or matter presented to it for decision, separate reports

shall be made by the commissioners on each side to their own Government. The high contracting parties shall thereupon endeavor to agree upon an adjustment of the question or matter of difference, and if an agreement is reached between them it shall be reduced to writing in the form of a protocol, and shall be communicated to the commissioners, who shall take such further proceedings as may be necessary to carry out such agreement.

ARTICLE IX.

The high contracting parties further agree that any other questions or matters of difference arising between them involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along the common frontier between the United States and the Dominion of Canada, shall be referred from time to time to the International Joint Commission for examination and report, whenever either the Government of the United States or the Government of the Dominion of Canada shall request that such questions or matters of difference be so referred.

The International Joint Commission is authorized in each case so referred to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

Such reports of the commission shall not be regarded as decisions of the questions or matters so submitted either on the facts or the law, and shall in no way have the character of an arbitral award.

The commission shall make a joint report to both Governments in all cases in which all or a majority of the commissioners agree, and in case of disagreement the minority may make a joint report to both Governments or separate reports to their respective Governments.

In case the commission is evenly divided upon any question or matter referred to it for report, separate reports shall be made by the commissioners on each side to their own Government.

ARTICLE X.

Any questions or matters of difference arising between the high contracting parties involving the rights, obligations, or interests of the United States or of the Dominion of Canada either in relation to each other or to their respective inhabitants, may be referred for decision to the International Joint Commission by the consent of the two parties, it being understood that on the part of the United States any such action will be by and with the advice and consent of the Senate, and on the part of His Majesty's Government with the consent of the Governor General in Council. In each case so referred the said commission is authorized to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

A majority of the said commission shall have power to render a decision or finding upon any of the questions or matters so referred.

If the said commission is equally divided or otherwise unable to render a decision or finding as to any questions or matters so referred, it shall be the duty of the commissioners to make a joint report to both governments, or separate reports to their respective governments, showing the different conclusions arrived at with regard to the matters or questions so referred which questions or matters shall thereupon be referred for decision by the high contracting parties to an umpire chosen in accordance with the procedure prescribed in the fourth, fifth, and sixth paragraphs of article XLV of the Hague Convention for the pacific settlement of international disputes. dated October 18, 1907. Such umpire shall have power to render a final decision with respect to those matters and questions so referred on which the commission failed.

ARTICLE XI.

A duplicate original of all decisions rendered and joint reports made by the commission shall be transmitted to and filed with the Secretary of State of the United States and the Governor-General of the Dominion of Canada, and to them shall be addressed all communications of the commissions.

ARTICLE XII.

The International Joint Commission shall meet and organize at Washington promptly after the members thereof are appointed, and when organized the commission may fix such times and places for its meetings as may be necessary, subject at all times to special call or direction by the two governments. Each commissioner, upon the first joint meeting of the commission after his appointment, shall, before proceeding with the work of the commission, make and subscribe a solemn declaration in writing that he will faithfully and impartially perform the duties imposed upon him under this treaty, and such declaration shall be entered on the records of the proceedings of the commission.

The United States and Canadian sections of the commission may each appoint a secretary, and these shall act as joint secretaries of the commission at its joint sessions, and the commission may employ engineers and clerical assistants from time to time as it may deem advisable. The salaries and personal expenses of the commission and of the secretaries shall be paid by their respective governments, and all reasonable and necessary joint expenses of the commission incurred by it shall be paid in equal moieties by the high contracting parties.

The commission shall have power to administer oaths to witnesses, and to take evidence on oath whenever deemed necessary in any proceeding, or inquiry, or matter within its jurisdiction under this treaty, and all parties interested therein shall be given convenient opportunity to be heard, and the high contracting parties agree to adopt such legislation as may be appropriate and necessary to give the commission the powers above mentioned on each side of the boundary, and to provide for the issue of subpoenas and for compelling the attendance of witnesses in proceedings before the commission. The commission may adopt such rules of procedure as shall be in accordance with justice and equity and may make such examination in person and through agents or employees as may be deemed advisable.

ARTICLE XIII.

In all cases where special agreements between the high contracting parties hereto are referred to in the foregoing articles,

such agreements are understood and intended to include not only direct agreements between the high contracting parties, but also any mutual arrangement between the United States and the Dominion of Canada expressed by concurrent or reciprocal legislation on the part of Congress and the Parliament of the Dominion.

ARTICLE XIV.

The present treaty shall be ratified by the President of the United States of America, by and with the advice and consent of the Senate thereof, and by His Britannic Majesty. The ratifications shall be exchanged at Washington as soon as possible and the treaty shall take effect on the date of the exchange of its ratifications. It shall remain in force for five years, dating from the day of exchange of ratifications, and thereafter until terminated by twelve months' written notice given by either high contracting party to the other.

In faith whereof the respective plenipotentiaries have signed this treaty in duplicate and have hereunto affixed their seals.

Done at Washington the 11th day of January, in the year of our Lord one thousand nine hundred and nine.

(Signed) ELIHU ROOT. [SEAL.]
(Signed) JAMES BRYCE. [SEAL.]

And whereas, the Senate of the United States by their resolution of March 3, 1909 (two-thirds of the Senators present concurring therein), did advise and consent to the ratification of the said treaty with the following understanding, to wit:

Resolved further (as a part of this ratification), That the United States approves this treaty with the understanding that nothing in this treaty shall be construed as affecting or changing any existing territorial or riparian rights in the water, or rights of the owners of lands under water, on either side of the international boundary at the rapids of the St. Mary's river at Sault Ste. Marie, in the use of the waters flowing over such lands, subject to the requirements of navigation in boundary waters, and of navigation canals, and without prejudice to the existing right of the United States and Canada, each to use the waters of the St. Mary's river within its own territory; and further, that nothing

in this treaty shall be construed to interfere with the drainage of wet, swamp, and overflowed lands into streams flowing into boundary waters, and that this interpretation will be mentioned in the ratification of this treaty as conveying the true meaning of the treaty, and will, in effect, form part of the treaty.

And whereas the said understanding has been accepted by the Government of Great Britain, and the ratifications of the two governments of the said treaty were exchanged in the city of Washington, on the 5th day of May, one thousand nine hundred and ten;

Now, therefore, be it known that I, William Howard Taft, President of the United States of America, have caused the said treaty and the said understanding, as forming a part thereof, to be made public, to the end that the same and every article and clause thereof may be observed and fulfilled with good faith by the United States and the citizens thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the United States to be affixed.

Done at the city of Washington this thirteenth day of May, in the year of our Lord one thousand nine hundred and ten, and of the independence of the United States of America the one hundred and thirty-fourth.

WM. H. TAFT.

[SEAL.]

By the President:

P. C. KNOX,

Secretary of State.

Protocol of Exchange.

On proceeding to the exchange of the ratifications of the treaty signed at Washington on January 11, 1909, between the United States and Great Britain, relating to boundary waters and questions arising along the boundary between the United States and the Dominion of Canada, the undersigned plenipotentiaries, duly authorized thereto by their respective governments, hereby declare that nothing in this treaty shall be construed as affecting, or

changing, any existing territorial or riparian rights in the water, or rights of the owners of lands under water, on either side of the international boundary at the rapids of the St. Mary's river at Sault Ste. Marie, in the use of the waters flowing over such lands, subject to the requirements of navigation in boundary waters and of navigation canals, and without prejudice to the existing right of the United States and Canada, each to use the waters of the St. Mary's river, within its own territory; and further, that nothing in this treaty shall be construed to interfere with the drainage of wet, swamp and overflowed lands into streams flowing into boundary waters, and also that this declaration shall be deemed to have equal force and effect as the treaty itself and to form an integral part thereto.

The exchange of ratifications then took place in the usual form.

In witness whereof they have signed the present protocol of exchange and have affixed their seals thereto.

Done at Washington this 5th day of May, one thousand nine hundred and ten.

PHILANDER C. KNOX, [SEAL.]
JAMES BRYCE. [SEAL.]

APPENDIX D

DECISIONS AND MEMORANDA ON WATER SUPPLY APPLICATIONS, OCTOBER 1, 1911 TO SEPTEMBER 30, 1912.

APPENDIX D

DECISIONS OF THE COMMISSIONS ON WATER SUPPLY APPLICATIONS.

The following table contains a list of the applications filed with this Commission and the State Water Supply Commission since the creation of the latter, together with the disposition made of each case:

No.	Applicant	Date of filing	Disposition	
1.	City of New York..........	Nov. 3, 1905.	Approved	May 14, 1906.
2.	City of Kingston	Nov. 8, 1905.	Discontinued..	
3.	City of Oneida	Dec. 2, 1905.	Approved	Mar. 16, 1906.
4.	Village of Lyons Falls......	Dec. 26, 1905.	Approved	Mar. 28, 1906.
5.	Village of Constableville	Dec. 30, 1905.	Approved	Apr. 19, 1906.
6.	City of Watervliet.........	Jan. 25, 1906.	Dismissed	Sept. 25, 1906.
7.	Village of Millbrook	Feb. 21, 1906.	Withdrawn	Mar. 5, 1906.
8.	Village of White Plains....	Apr. 20, 1906.	Approved	June 15, 1906.
9.	City of Lockport...........	May 24, 1906.	Approved	July 13, 1906.
10.	Village of Malone	June 28, 1906.	Approved	Jan. 18, 1907.
11.	Village of Holland Patent..	Aug. 25, 1906.	Approved	Sept. 25, 1906.
12.	Village of Brewster	Oct. 12, 1906.	Approved	Feb. 21, 1907.
13.	Village of Bergen	Oct. 18, 1906.	Approved	Nov. 8, 1906.
14.	City of Gloversville	Nov. 27, 1906.	Approved	Jan. 18, 1907.
15.	Village of Carthage.........	Dec. 13, 1906.	Approved	Mar. 14, 1907.
16.	Hannacroix Water Co......	Dec. 22, 1906.	Approved	Oct. 17, 1907.
17.	City of Plattsburg..........	Jan. 19, 1907.	Approved	Feb. 27, 1907.
18.	Village of Pleasantville.....	Feb. 9, 1907.	Approved	Aug. 6, 1907.
19.	Village of Seneca Falls	Feb. 21, 1907.	Approved	Oct. 16, 1907.
20.	Village of Waterville.......	Mar. 6, 1907.	Approved	May 9, 1907.
21.	Village of Old Forge	Mar. 13, 1907.	Approved	May 9, 1907.
22.	Village of Ossining.........	Mar. 13, 1907.	Approved	Nov. 26, 1907.
23.	Village of Peekskill........	Mar. 15, 1907.	Discontinued.	
24.	Urban Water Supply Co....	May 22, 1907.	Approved	July 16, 1907.
25.	Village of East Aurora.....	June 13, 1907.	Approved	July 18, 1907.
26.	Martinsburg Water District.	July 2, 1907.	Approved	July 15, 1907.
27.	City of New York—Modification of Catskill Aqueduct line	July 12, 1907.	Approved	Oct. 15, 1907.
28.	City of New York — Schoharie watershed	July 12, 1907	Discontinued.	
29.	City of Rome.............	July 20, 1907.	Approved	Aug. 15, 1907.
30.	Tannersville Water Co......	Aug. 23, 1907.	Approved	Dec. 21, 1907.
31.	Great South Bay Water Co..	Dec. 14, 1907.	Approved	Jan. 21, 1908.

No.	Applicant	Date of filing	Disposition
32.	City of Gloversville (second application)	Jan. 16, 1908.	Approved Feb. 18, 1908.
33.	Village of McGrawville	Jan. 20, 1908.	Approved Mar. 11, 1908.
34.	Village of Malone	Feb. 12, 1908.	Discontinued.
35.	Village of Bainbridge	Feb. 20. 1908.	Discontinued.
36.	Staatsburg Water Co	Mar. 6, 1908.	Approved Apr. 10, 1908.
37.	Village of Briarcliff Manor	Apr. 18, 1908.	Discontinued.
38.	Palenville Water District	July 16, 1908.	Petition not completed.
39.	Harmon Water Co	Apr. 27, 1908.	Withdrawn Sept. 16, 1908.
40.	City of New York — Suffolk county sources	July 29, 1908.	Pending.
41.	Village of East Syracuse	July 30, 1908.	Approved Aug. 14, 1908.
42.	Edmeston Water Co	Aug. 14, 1908.	Approved Sept. 16, 1908.
43.	Village of Marcellus	Aug. 24, 1908.	Approved Sept. 30, 1908.
44.	Village of Shortsville	Oct. 5, 1908.	Approved Feb. 6, 1909.
45.	Village of Clifton Springs	Oct. 5, 1908.	Approved Oct. 14, 1908.
46.	Village of Webster	Nov. 23, 1908.	Approved Dec. 12, 1908.
47.	Syracuse Suburban Water Co.	Dec. 1, 1908.	Approved Apr. 9, 1909.
48.	Village of White Plains (second application)	Dec. 30, 1908.	Approved Nov. 30, 1909.
49.	City of Glens Falls	Mar. 6, 1909.	Approved Apr. 21, 1909.
50.	City of New York — Nassau county sources	Mar. 12, 1909.	Approved May 15, 1909.
51.	Village of Bainbridge (second application)	Mar. 16, 1909.	Approved Aug. 18, 1909.
52.	Fultonville Water Co	Mar. 17, 1909.	Combined with No. 57.
53.	Village of West Carthage	Apr. 7, 1909.	Approved Apr. 22, 1909.
54.	Rensselaer Water Co	Apr. 12, 1909.	Approved Apr. 21, 1909.
55.	City of Niagara Falls	Apr. 20, 1909.	Approved July 14, 1909.
56.	Village of Webster (amended application)	May 5, 1909.	Approved June 15, 1909.
57.	Village of Canajoharie	June 1, 1909.	Approved Mar. 10, 1910.
58.	Village of Croghan	June 17, 1909.	Approved Sept. 22, 1909.
59.	Village of Mechanicville	June 22, 1909.	Approved July 13, 1909.
60.	Central Bridge Water Co	July 2, 1909.	Approved July 29, 1909.
61.	Whitney's Point Water Co	July 8, 1909.	Approved July 30, 1909.
62.	Water District of Town of Petersburg	July 15, 1909.	Approved Oct. 14, 1909.
63.	Village of Livonia	July 16, 1909.	Approved Oct. 21, 1909.
64.	Village of Mt. Morris	Aug. 2, 1909.	Discontinued.
65.	Village of Painted Post	Aug. 18, 1909.	Approved Sept. 3, 1909.
66.	Village of Farmingdale	Sept. 22, 1909.	Discontinued.
67.	City of New York—Modification of Catskill Aqueduct	Dec. 16, 1909.	Approved Oct. 7, 1910.
68.	Village of Barker	Jan. 11, 1910.	Discontinued.
69.	Jamaica Water Supply Co	Jan. 13, 1910.	Approved Feb. 15, 1910.
70.	Village of Pike	Feb. 3, 1910.	Approved Mar. 10, 1910.
71.	Village of Keeseville	Mar. 4, 1910.	Approved May 25, 1910.
72.	Otisville Water District	Apr. 4, 1910.	Approved Nov. 30, 1910.

No.	Applicant	Date of filing	Disposition	
73.	Village of Spencerport......	Mar. 23, 1910.	Approved	May 10, 1910.
74.	City of Plattsburg..........	Mar. 24, 1910.	Denied	May 20, 1910.
75.	Village of Croton-on-Hudson.	Apr. 6, 1910.	Approved	Aug. 24, 1910.
76.	Harrison Water District No. 1	Apr. 18, 1910.	Approved	May 20, 1910.
77.	Greenwich Union Water Works Co.	Apr. 29, 1910.	Approved	May 11, 1910.
78.	Village of Black River......	May 3, 1910.	Approved	May 20, 1910.
79.	Belfast Water District......	May 26, 1910.	Approved	July 7, 1910.
80.	Village of Moravia.........	July 6, 1910.	Approved	Aug 24, 1910.
81.	Village of Canajoharie......	July 13, 1910.	Approved	Aug. 10, 1910.
82.	Village of Youngstown......	July 20, 1910.	Approved	Aug. 24, 1910.
83.	City of Hornell............	Aug. 4, 1910.	Approved	Aug. 24, 1910.
85.	City of Ithaca.............	Aug. 22, 1910.	Approved	Nov. 3, 1910.
84.	Village of Silver Springs...	Aug. 12, 1910.	Approved	Oct. 7, 1910.
86.	Roslyn Water District......	Aug. 17, 1910.	Approved	Oct. 25, 1910.
87.	Village of Cherry Creek....	Sept. 6, 1910.	Approved	Oct. 7, 1910.
88.	Andes Water Co...........	Sept. 12, 1910.	Approved	Oct. 7, 1910.
89.	Village of Oriskany Falls....	Oct. 11, 1910.	Approved	Nov. 3, 1910.
90.	Summerville Water District.	Oct. 20, 1910.	Withdrawn	Oct. 28, 1910.
91.	John A. Drew.............	Oct. 28, 1910.	Approved	Dec. 29, 1910.
92.	Village of Angola...........	Dec. 7, 1910.	Approved	Dec. 29, 1910.
93.	Village of Avoca	Jan. 25, 1911.	Approved	Feb. 10, 1911.
94.	Westbury Water District....	Feb. 21, 1911.	Approved	Apr. 7, 1911.
95.	Weedsport Water Co........	Mar. 1, 1911.	Approved	Mar. 22, 1911.
96.	City of Gloversville........	Apr. 26, 1911.	Approved	June 16, 1911.
97.	Village of Cornwall........	May 24, 1911.	Approved	June 6, 1911.
98.	City of Cortland...........	June 17, 1911.	Approved	July 11, 1911.
99.	Castle Heights Water Co....	July 6, 1911.	Approved	Sept. 25, 1911.
100.	Village of Mexico..........	Aug. 12, 1911.	Disapproved	Apr. 15, 1912.
101.	New York City — Borough of Richmond	Sept. 12, 1911.	Approved	June 3, 1912.
102.	New York City — Borough of Brooklyn	Sept. 12, 1911.	Discontin'd	Apr. 29, 1912.
103.	Manhasset—Lakeville Water District	Oct. 24, 1911.	Approved	Dec. 20, 1911.
104.	Village of Argyle..........	Dec. 9, 1911.	Approved	Feb. 28, 1912.
105.	Staatsburg Water Co.......	Dec. 11, 1911.	Approved	Jan. 25, 1912.
106.	Village of Albion...........	Jan. 31, 1012.	Pending.	
107.	East Williston Water District	Feb. 16, 1912.	Approved	Apr. 30, 1912.
108.	Village of Middleport.......	Feb. 19, 1912.	Approved	Apr. 15, 1912.
109.	Baldwin Water Co..........	Mar. 29, 1912.	Approved	May 6, 1912.
110.	New York City — Schoharie Watershed	Apr. 2, 1912.	Pending.	
111.	Village of Grandview.......	Apr. 3, 1912.	Approved	May 27, 1912.
112.	Village of Piermont........	Apr. 19, 1912.	Approved	May 27, 1912
113.	Hartsdale Water District...	Apr. 15, 1912.	Approved	June 4, 1912.
114.	Village of Wolcott..........	Apr. 22, 1912.	Approved	June 4, 1912.

No.	Applicant	Date of filing	Disposition	
115.	Spring Valley Water Works & Supply Co.	Apr. 27. 1912.	Approved	May 27, 1912
116.	Village of Mt. Morris	May 10, 1912.	Pending.	
117.	Village of Peekskill	May 14, 1912.	Approved	July 31, 1912.
118.	Village of Fayetteville	May 27, 1912.	Approved	July 31, 1912.
119.	Village of Port Leyden	June 7, 1912.	Approved	Sept. 10, 1912.
120.	Rochester & Lake Ontario Water Co.	June 14, 1912.	Approved	July 31, 1912.
121.	Village of Briarcliff Manor	June 22, 1912.	Incomplete.	
122.	Sodus Water District	July 9, 1912.	Approved	Sept. 10, 1912.
123.	Village of LaSalle	July 9, 1912.	Approved	July 31, 1912.
124.	City of Cortland	June 22, 1912.	Approved	July 31, 1912.
125.	Village of Brockport	July 23, 1912.	Pending.	
126.	Locke Water District No. 1	July 27, 1912.	Approved	Sept. 24, 1912.
127.	Madrid Water District	Aug. 31, 1912.	Pending.	
128.	Albion Water Works Co.	Sept. 11, 1912.	Pending.	
129.	North End Water District — Town of Scarsdale	Sept. 16, 1912.	Pending.	
130.	New Castle Water Co.	Sept. 23, 1912.	Incomplete.	

WATER SUPPLY APPLICATION NO. 40.

City of New York — Suffolk County Sources.

Petition filed July 29, 1908.

Hearing held September 10, 1908, and adjourned from time to time thereafter to November 15, 1911, May 28, 1912, and finally adjourned to November 18, 1912.

Petition asked for approval of plan of augumenting the water supply of the city of New York by the drilling of many driven wells in Suffolk county.

The city of New York is not yet ready to close these proceedings and they are therefore being kept open by adjourning the hearing from time to time.

APPLICATION 100.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the VILLAGE OF MEXICO, N. Y., for approval of its maps, plans and profiles for a municipal waterworks system. } *Decision.*

Application filed August 12, 1911.

Hearings held at Mexico, September 12, 1911 and January 3, 1912.

Decision April 15, 1912.

Disapproved.

The petition of the Village of Mexico, by its Board of Trustees, together with the maps, plans and profiles, sets forth the following:

Mexico is an incorporated village, organized in the year 1851. The population of the last census was 1232; the assessed valuation is about $500,000 and there is at present no bonded indebtedness.

Mexico is entirely without a public system of water supply for domestic purposes or fire protection. On April 11, 1911, at a special election, it was voted to issue bonds in the amount of $40,000 for the purpose of installing and establishing a system of water works. The board of trustees of the village engaged the services of Mr. W. G. Stone, Civil Engineer, to prepare maps and plans for a proposed system of water supply and Mr. Stone's maps, report and estimate have been submitted in connection with this application.

The proposed source of supply for the village is the Gillette spring, situated some four miles south of the village at the headwaters of the easterly branch of Black creek. This is a large spring situated near the southerly margin of a rather extensive area of swamp, the apparent watershed tributary to the swamp being about one-quarter of a square mile of farm, swamp and woodland with one or two farm houses upon its extreme margin. A proposed addition to this source of supply is the so-called Pine Tree spring, perhaps a mile and a half nearer the village along the same stream. Mr. Stone estimated that the discharge in the Gillette spring on June 1, 1911, was 218,000 gallons per day and he estimates that at all times it will yield more than the 74,000 gallons per day, which is the present estimated consumption of the village.

Chemical and bacteriological analyses from the water of the spring and outlet stream were submitted and an examination of the spring and watershed has been made. These indicate that the water of the spring itself is of suitable sanitary and chemical quality for use as a domestic supply, but that water flowing from the spring through the swamp is at present contaminated to a certain extent, and that in order to prevent this contamination it will be necessary to clean up the entire swamp, fence it so as to prevent the pasturing of cattle therein and exercise considerable sanitary supervision over the watershed.

It is proposed to intercept the flow from the Gillette spring near the northerly margin of the swamp by a small concrete dam. From thence the water would flow by gravity through an eight-inch wooden stave pipe to a point near the village known as the Davis Mill site. Here it is proposed to erect a pumping station, run partly by water power developed on the Black creek at this point and partly by an oil engine, water to be pumped to a standpipe of 228,000 gallons capacity which it is proposed to build on a hill near the southeastern corner of the corporate limits of the village. From this standpipe the water would flow through mains and pipes laid in the streets to various parts of the village. Hydrants are provided at suitable intervals. In case of fire, the pumps can be operated directly into the mains and will furnish enough water for an additional stream, in addition to the water from the standpipe. Mr. Stone estimates the cost of these works as $39,896.20. This estimate is exclusive of engineering and legal expenses.

After due notice in the *Oswego Daily Palladium* and the *Mexico Independent*, hearings were held in the village of Mexico on September 12, 1911, and January 3, 1912. At these hearings objections were raised to the proposed plans, as shown by the brief of Messrs. Morehouse, Mizen and Morehouse, attorneys for C. H. Graves and other objectors. These objections were based upon two grounds. First, that the proposed source of supply is inadequate for the present and future needs of the village, it being claimed that the discharge of the spring fluctuates and that the lowest flow will not be sufficient. Second, it is claimed that the proposed project cannot be constructed within the appropriation of $40,000 and that therefore no provision has been made for the payment of damages which may be caused by the construction of the works. It was also brought out in the hearings that no investigation has been made of, or consideration given to, any source of supply other than the Gillette and Pine Tree springs.

After due consideration of the petition; the supplementary report and estimates submitted by Mr. Stone, engineer for the village; the evidence introduced in the hearings and the reports of the Commission's engineers, it appears that: In all probability the Gillette spring itself will not yield enough water for the present needs of the village of Mexico. If the whole area of the swamp surrounding the spring is taken as a source of water supply the yield may be sufficient, but in all probability the quality will not be such as to be desirable for domestic use. No consideration has been given in the estimate of cost of the work necessary to put the swamp in sanitary condition, to fence the same, to clean up and protect the surrounding territory, nor has provision been made for the payment of engineering and legal expenses. The works, as proposed, cannot be constructed either for the sum estimated by Mr. Stone or for the sum appropriated by the village. If when the maximum yield of the Gillette spring is developed it becomes necessary for the village to obtain additional water, due to increase in population or consumption, it will be necessary to search for another source of supply, as that proposed is incapable of further extension at reasonable cost. There are near the village other sources of supply, notably Black creek and the Little Salmon river, from which water could be pumped directly, or pumped from wells or infiltration galleries situated near these streams, but no study or investigation has been made of water

from these sources, nor has any evidence been introduced to show that they are not more suitable sources of supply than that proposed.

For consideration of these facts, the Commission, therefore, finds and determines that the said Gillette spring, as a source of water supply for the village of Mexico, is so inadequate in quantity and unsatisfactory in quality that the expenditure necessary to utilize it is not justified by public necessity, unless it can be shown that it is impossible to obtain a larger and more satisfactory supply elsewhere at a reasonable cost.

The Commission considers it unnecessary to make further determination at this time.

Therefore, upon the above grounds, the application of the Village of Mexico is hereby denied.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and disapproval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed [L. S.] the same, with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 15th day of April, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

APPLICATION 101.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter
of the
Application of the CITY OF NEW YORK for the approval by the State Conservation Commission of certain maps and plans prepared by the Commissioner of Water Supply, Gas and Electricity, in order that certain lands in the BOROUGH OF RICHMOND, city of New York, may be acquired for new and additional sources of water supply. } *Decision.*

Petition filed September 12, 1911.

Hearing held in Brooklyn, April 18, 1912.

Decision June 3, 1912.

Approved.

On September 12, 1911, the City of New York, by its mayor and city clerk, filed with the Conservation Commission an application for approval of its proposed acquisition of an additional source of water supply for the borough

of Richmond, and of the maps and plans for the waterworks construction necessary to utilize such additional source of supply. The site of the proposed works was inspected by one of the engineering staff of this Commission March 16, 1912.

Subsequent to due notice published in the *Staten Island World*, *New York Daily Telegraph* and *New York Ledger*, a hearing was held in borough hall, Brooklyn, on April 18, 1912. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. No objectors to this application appeared.

After due study of the petition and its exhibits, evidence and arguments given at the hearing and the report of the Commission's engineer, it appears as follows:

The City of New York is a municipal corporation existing under chapter 466 of the Laws of 1901, the amended and revised Greater New York Charter, and acts amendatory thereof and supplementary thereto. The borough of Richmond is a subdivision of the city, covering Staten Island. The present population of this borough is estimated as about 86,000.

Richmond at the present time is supplied with water from driven-well stations, situated in various parts of the Island, six owned and operated by the city and one by a private water company in New Dorp. The present consumption is approximately 9,000,000 gallons per day. This water is all drawn from driven wells and in many places the wells have been so overdrawn as to deplete the natural ground water storage with the result that sea water is working back into the wells, so that the hardness and chlorine content have increased to an extent such that the greater part of the water is no longer desirable for domestic use. During January, 1912, the Clove and Third street reservoirs were entirely emptied in spite of this overdraught on the wells.

In order to relieve the shortage of water in this Borough, the Commissioner of Water Supply, Gas and Electricity, in August of 1910, selected an additional source of supply along the Southfield boulevard. Public hearing upon this project was held before the Board of Estimate and Apportionment on the fourth day of November, 1910. There was no opposition to the project, which was, therefore, duly approved and finally adopted by the Board. There is available for the construction of the connecting piping and the purchase of the necessary land an appropriation of $100,000, approved by the Board of Aldermen and the Mayor in October, 1911. The contracts for the wells and the pumping station building at Grant City, have been certified for payment from a previous appropriation.

The additional supply for which the city now petitions is to consist of four groups of fourteen wells each, situated along the Southfield boulevard, from which the water is to be pumped to the Grant city pumping station, now being reconstructed, and from thence to the Third street reservoir to reinforce the present supply. The wells will be sunk along the southerly margin, or in the outwash from the terminal moraine, which covers the northerly portion of Staten Island. The probable watershed is approximately five square miles in extent. Water is to be obtained from a depth of not less than 40 feet below the surface.

It is estimated that these wells will yield about 4,000,000 gallons per day, these figures having been derived by comparison with similar wells in the neighborhood and test pumping in some wells which have already been sunk. This additional quantity of water, it is expected, will be sufficient for the needs of the Borough until the Catskill supply becomes available in 1916.

Analyses of water from such wells as have already been sunk in the proposed area indicate that this water is suitable for domestic purposes. An inspection of the watershed does not indicate any great danger of pollution from sewage. There are at the present time no sewers in the Southfield boulevard and practically no buildings along or near it. Any contamination that might enter the ground water up stream from these wells would probably be filtered out before reaching them.

The proposed wells are to be of a driven, tubular type, sunk just inside of the boundary of Southfield boulevard, spaced about one hundred feet apart in four groups as before mentioned. At each group will be provided a small electrically driven pumping station, which will probably be situated just outside the boulevard on land to be acquired for the purpose. Water from these pumping stations will be forced through a collecting pipe, to be laid along and just inside of the margin of the boulevard, to the rebuilt Grant city pumping station. From this station it will be pumped through a force main to the Third street reservoir.

As far as can be judged from the plans submitted, the proposed structures will be safe, if well built with proper materials.

It is proposed to acquire four small parcels of land for the auxiliary pumping stations, above mentioned, the remainder of the piping will be laid either in public streets or in land already owned by the city.

All the public water supplies of Staten Island are obtained from driven wells, and there is no other source of water supply in the island itself. It was previously intended to supplement the present supply by water from New Jersey, but this was prevented by legislation. Later it was proposed to construct the Narrows siphon of the Catskill aqueduct and to pump water from the Brooklyn water works to Richmond. This idea was abandoned on account of shortage of water in the Borough of Brooklyn. The Catskill water will be available in 1916 and will render the bulk of the present well stations unnecessary. They will then be shut down and held in reserve in case of accident to the Catskill mains.

There is but one private water company operating on Staten Island — the New Dorp Water Company, supplying what was formerly the Village of New Dorp. This company takes its water from the same watershed as the proposed works, but its consumption is very small, 100,000 to 200,000 gallons daily, and as its wells are up stream from the proposed wells, it ought not to be affected by the proposed construction.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the City of New York is hereby approved and permission to construct the desired works is granted, subject to further inspection by this Commission, as provided by section 523 of the conservation law.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 3d day of June, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

APPLICATION 102.

City of New York — Borough of Brooklyn.

Petition filed September 12, 1911.

Petition asked for approval of plan to augument the water supply of the Borough of Brooklyn of the City of New York by driving wells upon four parcels of land, which it was proposed to acquire, within the limits of that borough.

No hearing was held upon this application and on April 29, 1912, the petition was withdrawn by the New York City authorities.

APPLICATION 103.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the Water Commissioners of the MANHASSET-LAKEVILLE WATER DISTRICT of the town of North Hempstead, county of Nassau, State of New York, for the approval of its maps and plans for a new water supply.	*Decision.*

Application filed October 24, 1911.
Hearing December 8, 1911.
Decision December 20, 1911.
Approved.

The petition and other papers filed and evidence taken at the hearing show that —

1. On the 23d day of May, 1911, the Manhasset-Lakeville Water District was duly established by order of the Town Board of the Town of North Hempstead, in accordance with article 13, sections 282 to 285 of the Town Law.

2. On the same day Messrs. Daniel S. Wooley, Owen P. Kennedy, and John M. Belknap were by said town board appointed Water Commissioners of said district, and said Commissioners subsequently thereto duly qualified for said office of Water Commissioner of said district.

3. On October 24, 1911, the said Commissioners of the said water district filed a petition with the Conservation Commission for the approval of its maps and plans, together with said maps and plans and other documents.

4. After due public notice, a hearing was held on the 8th day of December, 1911, at the Manhasset Town Hall by Commissioner John D. Moore.

5. The number of inhabitants in said district is 2,800. The total assessed valuation of the property included in the district is $1,605,813 as shown by the assessment roll of 1910, with no outstanding obligations against the district as a water district.

6. The present water supply for the inhabitants of said district is obtained almost entirely from shallow wells, furnishing no fire protection and water of variable quality.

7. The proposed supply is to be taken from the well known underground supplies of Long Island, whose uniform purity and general excellence has been well established by long use. The good quality of the proposed supply is further shown by an analysis.

8. The plans and estimates have been prepared by competent engineers.

9. The estimated cost of the entire work is $140,630.

10. No other municipal corporation or civil division of the State, or the inhabitants thereof, will be affected by the plans of the petitioners, and no indirect damages will result from the execution thereof, and as to direct

damages a just and equitable plan to determine and provide payment therefor has been devised, said plan being to purchase required lands when practicable and otherwise to acquire them by condemnation proceedings in accordance with law.

11. No objections were filed and there were no adverse appearances at the hearing.

The Commission, therefore, finds and determines:

First. That the plans proposed for the Manhasset-Lakeville water district are justified by public necessity.

Second. That such plans are just and equitable to the other municipalities and civil divisions of the State affected thereby, and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Third. That said plans make fair and equitable provisions for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans, or the acquiring of lands.

The Commission does, therefore, approve the plans submitted and grant the application of the petitioner.

[L. S.] IN WITNESS WHEREOF, the State Conservation Commission hath caused this determination and approval to be signed by the Commission and caused its official seal to be affixed hereto and the same, with all plans, maps and other documents relating thereto, filed in its office in the city of Albany, this 20th day of December, 1911.

CONSERVATION COMMISSION,
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

By the Commission:
ALBERT E. HOYT,
Secretary to Commission.

APPLICATION 104.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the VILLAGE OF ARGYLE for the approval of its plans for the construction of a Water Works System. — *Decision.*

Application filed December 9, 1911.
Hearing at Arygle January 5, 1912.
Decision February 28, 1912.
Approved.

The petition of the village of Argyle by its Board of Trustees, together with the maps, plans and profiles and the proof produced at the hearing held in the village of Argyle on January 5, 1911, set forth the following facts:

The village of Argyle was incorporated under Chapter 27 of the Laws of 1838 and reincorporated under Chapter 271 of the Laws of 1870 at a special election held August 29, 1899. The village had, at the last census, 235 inhabitants and has about the same number at the present time. The present assessed valuation is $90,837 and there is no bonded indebtedness whatever.

At present there is no public water supply system in the town, drinking water of poor quality being obtained from wells or cisterns. Fire protection is given only by an old hand fire engine, which takes water from these same wells or from the Moses Kill which is frequently dry in the summer months.

At a special election held November 16, 1911, a village bond issue, to the amount of $12,500 for the purpose of installing and establishing a system of water supply for the village, the water to be taken from Summit Lake, was authorized by unanimous vote.

The Board of Trustees of said village employed E. H. Welles, a civil engineer, to prepare maps and plans and the maps and plans prepared by the said Welles were approved and adopted by the Trustees and submitted for approval with the application.

The proposed source of supply is Summit Lake, about two miles southeast of the village. It is proposed to draw off the water by means of a pipe line laid in a tunnel now being constructed for the Washington County Almshouse, delivering it by gravity to a small reservoir near the village and from thence, also by gravity, through the streets of the village by suitable pipes and mains. Suitable fire hydrants are provided and the pressure will be such that no pumping of fire engine streams will be required. It appears that Summit Lake may reasonably be expected to supply more than enough water for the needs of the village for some years to come.

Analyses of the waters of the lake show considerable quantities of undecomposed organic matter and fecal organisms were moderately prevalent. It was shown that this condition was, in part, due to the fact that the samples were taken at the time of the fall overturn when the condition of the lake was at its worst, and that any direct contamination of the lake that might now exist could be readily prevented by certain proposed changes in the location of existing buildings and by the enforcing of suitable regulations by the local health authorities.

Objection to the proposed diversion of water from Summit Lake was made by certain property owners along the lake and the outlet thereto, who claimed that no provision had been made for payment to them of damages caused by lowering of water level in lake and outlet by the proposed diversion. It appeared that the probable maximum lowering of the lake surface due to the anticipated consumption of the present population would be less than an inch and that the outlet was at present dry for some months out of each year. It, therefore, appears that the village will be financially able to pay for such damages as might be awarded to these claimants.

Summit Lake is to be used as a source of water supply for the Washington County Almshouse; no other water supply system has been shown to be supplied from this source. This lake appears to be the proper and logical source of water supply for this village.

The works which it is proposed to construct can be safely constructed along the general lines shown by the plans submitted.

The Commission, therefore, finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby, and to the inhabitants thereof; particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all damages to persons and property, both direct and indirect, which wil result from the execution of said plans.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the same, with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 28th day of February, 1912.

CONSERVATION COMMISSION,
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

APPLICATION 105.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the STAATSBURG WATER COMPANY for the approval of its maps, and plans for the extension of its mains in the towns of Hyde Park and Rhinebeck. } *Decision.*

Application filed December 11, 1911.

Application approved January 25, 1912.

This is a proceeding had upon the application of the Staatsburg Water Company, filed December 11, 1911, with the Conservation Commission, as required by Article 9 of the Conservation Law, for permission to extend its mains from the Village of Staatsburg in the Town of Hyde Park into the Town of Rhinecliff, all in Dutchess county.

The petition and accompanying papers show that the Staatsburg Water Company is a domestic corporation duly organized under the laws of the State of New York; that said corporation on March 6, 1908, filed with the State Water Supply Commission an application for approval of maps, plans, and profiles for a new and additional water supply for the Village of Staatsburg, which application was granted March 18, 1908; that said corporation

thereupon constructed the works thus approved and since that time has supplied the inhabitants of said village with water; that during the summer of 1911 said corporation extended its mains into the Town of Rhinebeck for the purpose of supplying certain of the inhabitants of that town with water, they being without any public supply; that said corporation had supposed that permission for the construction of these extensions had been granted in the original approval, but that finding that this was not the case now asks for such approval from the Conservation Commission.

It was found upon examination of the papers and plans submitted that the district served by these extensions was not otherwise provided with a public supply and cannot well be supplied from any other existing water works system; that the source of supply used by the applicant gives water of suitable quality and in quantity sufficient to supply the probable population of the district served for many years to come; that this source of supply is not the natural or proper source of supply for any other district; that it is not proposed, nor was it necessary to acquire any land for these extensions, they being laid in public roads; and that the construction, as shown by the plans, was that which is customary in such cases.

It was not deemed necessary to hold a hearing.

The Conservation Commission, therefore, determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby, and to the inhabitants thereof; particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the [L. S.] same, with all maps, plans, surveys and other papers relating thereto, in its office in the city of Albany, this 30th day of January, 1912.

CONSERVATION COMMISSION,
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

APPLICATION 106.

Village of Albion, Orleans county, N. Y.

Application filed February 1, 1912.

Hearings held July 12, July 18 and July 25, 1912.

Petition asked for approval of a plan to take water from two driven wells south of the village and to construct a complete system of distribution piping in the village, water from the wells to be pumped, aerated and filtered.

The Albion Water Works Company is now operating in this village, taking its water from driven wells, from Otter Creek at Eagle Harbor and, at times, from the Barge canal.

Application was filed February 1, 1912, but at that time no referendum vote, authorizing a bond issue for the proposed construction, had been had. Petition modified June 14, 1912, by including in it the authorization of the bond issue by vote of the electors on May 31, 1912.

Three hearings have been held, but further hearings will be necessary.

APPLICATION 107.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the Water Commissioners of the EAST WILLISTON WATER DISTRICT in the Town of North Hempstead, Nassau county, N. Y., for the approval of its map, plans and profiles for a source of water supply.	*Decision.*

Application filed February 16, 1912.

Hearing at East Williston April 12, 1912.

Decision April 30, 1912.

Approved.

On February 16, 1912, the East Williston Water District, by its Board of Water Commissioners, filed with the Conservation Commission an application for the approval of its proposed acquisition of a source of water supply and of the maps and plans of the water works construction necessary to provide the district with water for domestic consumption and fire protection. The proposed source of supply for the district was inspected by one of the Engineering Staff of this Commission on March 15, 1912. Subsequent to due notice, published in the Roslyn News of Roslyn and the North Hempstead Record of Great Neck Station, a hearing was held in the East Williston Fire Hall, East Williston, on April 12, 1912. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. No objectors to the proposed work appeared.

After due study of the petition and its exhibits, evidence and arguments given at the hearing and the report of the Commission's Engineer, it appears as follows:

The East Williston Water District covers the unincorporated village of East Williston, lying in the southerly part of the town of North Hempstead, Nassau county, northeast of and adjoining the village of Mineola.

The water district was duly established by the Town Board of town of North Hempstead on November 24, 1911, as provided by section 282 of chapter 63 of the Laws of 1909. The Board of Water Commissioners was appointed on the 15th of December, 1911. The present population of the district is approximately 325 and the assessed valuation $276,000.

There is at the present time no public water supply or sewerage system within the district. Water for domestic purposes is now obtained from private wells, chiefly of the driven type, and there is practically no fire protection.

The board of water commissioners of the district engaged the firm of Fairfield & Dow as engineers, to prepare plans and estimates for a water supply system. The plans, estimates and report of these engineers were submitted with the application.

It is proposed to obtain water by purchase from the municipal plant of the village of Mineola. This water is obtained from two 12-inch driven wells which are said to be about ninety feet deep, in which the water stands thirty-five feet below the surface of the ground. From these wells the water is pumped by gasoline engines against seventy pounds pressure into a standpipe of 100,000 gallons capacity. The present rate of pumping is approximately 70,000 gallons per day, and the present population of the village of Mineola is about 2,200.

The village of Mineola has offered to extend an 8-inch pipe from its standpipe to the village limits, adjacent to the water district, and from this pipe to supply the district with water at the Mineola standpipe pressure for the sum of 14 cents per thousand gallons, provided that the minimum payment in any one year shall not be less than $400. These Mineola wells ought to yield more than sufficient water to supply the additional population which will become tributary to them by the construction of the proposed works.

The analysis of the Mineola well water, submitted with the application, does not indicate any pollution and shows the water to be of excellent sanitary quality and of fair quality in other respects. An examination of the ground around the wells does not show any reason to fear direct contamination. The area is fenced and grown up to grass. It is about the same general level as the surrounding country, somewhat higher than the railroad tracks which are adjacent to it; it is so far from the nearest buildings, and the water tables lies at such a depth as to make it improbable that direct contamination from cesspools can reach the water.

It is proposed to lay cast-iron pipes through the streets in the district, connecting these with the 8-inch line from the Mineola standpipe at the village boundary. At this point a meter will be installed in a suitable chamber in order that the water used may be accurately measured. Fire hydrants are to be installed at suitable intervals. The piping appears to be well arranged and of efficient size to give fair fire protection at all points.

The estimated cost of the works is about $14,000, including superintendence, engineering, etc., and it is probable that the works can be constructed for this sum.

Whenever the growth of the population of the village of Mineola causes the consumption of that place to equal the available yield of the wells, the East Williston District can be supplied either by the sinking of more wells on the Mineola property or by sinking wells and installing a pumping station and standpipe on property to be purchased inside of the district. At the present time it appears to be more economical for it to buy water, but this would not be the case if the population of the district were to increase largely.

As far as can be judged from the plans submitted, the proposed works will be safe, if well built with proper materials.

All piping is to be laid in the streets and it will, therefore, be unnecessary to acquire any land at the present time.

Practically all of this section of Long Island is supplied with water from driven wells similar to those at Mineola, so that the only alternative sources of supply for this district would be either to construct their own plant, which, as mentioned above, would be more expensive at the present time than the proposed method of purchasing the water; or to purchase water from some existing supply other than Mineloa. As the Mineola system is nearer than any other, this latter alternative does not appear to be feasible.

The proposed taking of water by this district does not affect the supply of any civil division of the State other than the village of Mineola, and the needs of the population of this village are apparently protected by the short term of the contract, which need not be renewed if the village requires the water for its own purposes at the time of expiration.

The legal damages which may be caused by this work do not appear to be such as required any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the East Williston Water District is hereby approved and permission to construct the desired works is granted, subject only to the condition that this construction shall,

before being operated, receive the further approval of this Commission, as provided by section 523 of the Conservation Law.

IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the [L. S.] same with all maps, plans, surveys and other papers relating thereto in its office in the City of Albany this 30th day of April, 1912.

CONSERVATION COMMISSION,
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

APPLICATION 108.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the Board of Trustees of the VILLAGE OF MIDDLEPORT for approval of the engineering and financial plans for acquisition of a water supply system in the Village of Middleport. } *Decision.*

Application filed February 19, 1912.
Hearing held at Albany April 4, 1912.
Decision April 15, 1912.
Approved.

On February 19, 1912, the village of Middleport, by its Board of Trustees filed with the Conservation Commission an application for the approval of its proposed acquisition of a source of water supply and of the maps and plans of the water works construction necessary to provide the village with water for domestic consumption and fire protection. The proposed source of supply for the village was inspected by the engineering staff of this Commission on March 21st. Subsequent to due notice published in the *Orleans County News* and the Middleport *Herald*, a hearing was held at the office of the Conservation Commission in Albany on April 4, 1912. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for and against the project, as shown by the minutes and briefs of the petitioner and objectors.

After due study of the petition and its exhibits, evidence, arguments and briefs submitted at the hearing it appears as follows:

Middleport is a village in the easterly part of Niagara county, situated on the line of the Erie canal. The village was incorporated under the general village laws in or about the year 1857. The present population is approximately 1,600 and the assessed valuation, according to the last assessment roll, $1,047,821.

At the present time there is neither a public water supply nor a public sewerage system in the village. Permit for construction of a sewerage system was granted the village authorities by the State Department of Health on January 18th and by the Conservation Commission on March 21st of the current year. Fire protection is now afforded by an old fashioned fire engine which draws water either from the canal or from tanks and cisterns which exist in various parts of the village. The supply so afforded is inadequate for proper fire protection, particularly during the season when the canal is empty. Water for domestic purposes is obtained from wells situated in various parts of the village. These wells are usually of the driven type and of moderate depth, yield but a limited supply and are in danger of contamination from neighboring cesspools.

On January 31, 1912, the voters of the town were asked to pass upon a proposed bond issue of $57,000 for the construction of a sewerage system and $48,000 for the construction of a water supply system. This proposition was carried by a large majority.

The Board of Trustees of the village engaged Mr. Charles C. Hopkins as engineer to prepare plans and estimates for the proposed water supply system. This was done and Mr. Hopkins' report, estimate, maps and drawings were submitted with the application.

It is proposed to obtain water from a well or wells now existing, or to be sunk at a distance of approximately 2 1/3 miles southerly and westerly from the village. These wells are upon the top of a broad, low ridge about a mile south of the New York Central tracks. A large well has been excavated at this point and two driven wells put down nearby. Extensive tests made under Mr. Hopkins' direction indicate a probable continuous yield of over 60,000 gallons per day, which he estimates will be sufficient for the needs of the present population of the village.

In quality the water appears to be suitable for domestic use. The analysis submitted with the application does not indicate sewage pollution, nor any objectionable constituents, except that the water is decidely hard, as is to be expected from a ground water in a limestone region. The wells are remote from any building, in a field which is suitable only for pasturage, and it appears that if a suitable area about them is fenced to keep cattle away from the immediate neighborhood, that there is little danger to fear from direct contamination.

It is proposed to excavate a large well, sixty-five feet in diameter and fourteen feet deep which will have a capacity of 100,000 gallons, will be lined with concrete and to which the nearest driven well will be connected. If necessary, other driven wells will be sunk in the neighborhood and also connected with the large well which will serve as a storage reservoir as well as a collecting tank.

Adjacent to the large well it is proposed to instal two pumps — one of 100,000 gallons capacity for ordinary purposes and one of 800,000 gallons for fire purposes. These pumps will probably be electrically operated and the smaller one automatically controlled by a pressure governor. The pumps will draw water from the large well and deliver it through an 8-inch main laid in the highway to a standpipe which it is proposed to construct within a mile of the village on a slight eminence. From the standpipe water will

pass into the village and be distributed through the streets by the usual system of distribution piping. This piping appears to be well arranged, considering the necessity of keeping the cost down to a minimum, hydrants are provided at suitable intervals and the pressure and sizes are sufficient to give fair fire protection in all parts of the village which it is proposed to pipe. The amount of the appropriation appears to be sufficient to cover the cost of the proposed works.

As far as can be judged from the plans submitted, the proposed works will be safe, if well built with proper materials.

In order to construct this proposed system, it will be necessary to purchase two parcels of land — one of two acres, which is the lot on which the wells have been sunk; the other of one-third acre, the lot on which the standpipe is to be erected. Practically all the piping is to be laid in public streets and roads.

Certain alternative sources of supply have been considered. These are: surface streams in the neighborhood, but the flow in them is extremely variable and the quality of water such that it would probably require filtration; the waters of the Erie canal, which are entirely unsuitable for sanitary reasons; and wells in other localities — these have not been looked into with care, as prospecting for water is an expensive process. It appears to be impossible for this village, acting alone, to obtain any gravity source of supply, except at prohibitive cost.

While it is difficult or impossible to trace the origin and course of flow of a ground water supply, it does not appear that the source which the village proposes to take is now used by any other civil division of the State, or that it is the logical source of supply for any other locality. The nearest place to the wells, except Middleport, is the unincorporated village of Gasport, which at the present time is not supplied with water and which doubtless could be supplied from wells nearer that village than those now under discussion.

The legal damages which may be caused by this work do not appear to be such as require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore determines and finds:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the village of Middleport is hereby approved and permission to construct the desired works is

granted, subject to further inspection by this Commission, as provided by section 523 of the Conservation Law.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the [L. S.] same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 15th day of April, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 109.

STATE OF NEW YORK CONSERVATION COMMISSION.

In the Matter of the Application of the BALDWIN WATER COMPANY to the Conservation Commission for the approval of its maps, plans and profiles for a new water supply and new sources of water supply. } *Decision.*

Petition filed March 29, 1912.
Hearing held at Baldwin, April 25, 1912.
Decision May 6, 1912.
Approved.

On March 29, 1912, the Baldwin Water Company, by its president, filed with the Conservation Commission an application for approval of its proposed acquisition of a source of water supply and of the maps and plans of the water works construction necessary to provide water for domestic consumption to what is known as the Eighth Election District of the town of Hempstead, Nassau county. The proposed source of supply for the district was inspected by one of the engineering staff of this Commission on April 12, 1912.

Subsequent to due notice published in the *South Side Observer* of Rockville Center and the *Nassau County Review* of Freeport, a hearing was held in Baldwin Hall at Baldwin on April 25, 1912. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. No objectors of the proposed work appeared. Subsequent to the hearing the company requested and was granted permission to make certain changes in their plans, these modifications not being of a nature such as to change the essential features of the project.

After due study of the petition and its exhibits, evidence and arguments given at the hearing, the report of the Commission's engineer and the plans as modified, it appears as follows:

The Baldwin Water Company is a domestic corporation, organized under and existing by virtue of Article 8 of the Transportation Corporations Law, its certificate of incorporation having been filed in the office of the Secretary of State August 13, 1909, and in the office of the clerk of the county of Nassau August 17, 1909. The authorized capital stock of the company is $28,000 and of this amount $9,100 has been fully paid in and issued, $4,800 has been in good faith subscribed for and $1,250 paid on account thereof. The franchise of the company covers that portion of the town of Hempstead known as the Eighth Election District. The population of this district is estimated as between 2,500 and 3,000.

There is at the present time no public water supply within this district. Water for domestic purposes is obtained from private wells, chiefly of the driven type and there is no fire protection. The Baldwin Water Company has not made any contract with the town of Hempstead to supply water for fire purposes, but negotiations with the town to that end are to be entered into in the near future.

The Baldwin Water Company engaged the firm of Smith & Malcomson, of Freeport, as engineers to prepare plans and estimates for a water supply system. The plans, estimates and report of these engineers were submitted with the application.

It is proposed to obtain water from wells to be driven near the west bank of Millburn creek, just north of Seaman avenue, about three-quarters of a mile north of the Long Island Railroad tracks. One or more wells will be driven as necessary in order to supply the demand. These wells are to be sunk in the well-known Long Island water bearing gravels, and it appears that, although this particular section is not as prolific in water as some others in the neighborhood, that a sufficient supply can probably be obtained.

The analysis of water obtained from a test well, as submitted with the application, indicates that the water will be of excellent sanitary quality. An examination of the ground around the wells does not show any great danger of contamination from neighboring buildings. There are no sewers near it and the nearest buildings are some distance away. This particular section is grown up to grass and trees and will be fenced. The direction of movement of the ground water is such that any sewage which would tend to get into it from the buildings nearest to the site of the wells will tend to move away from them, so that the chances of pollution are small.

Water from the wells will be pumped through cast iron pipes laid in the streets in the usual manner. The piping appears to be well arranged and of sufficient size to give fair fire protection when hydrants are installed for this purpose. The piping which it is now proposed to install is of such size as to enable large extensions to be made as required.

As far as can be judged from the plans submitted, the proposed structures will be safe, if well built with proper materials.

The estimated cost of installing the system, as given by the report of the company's engineers, is $25,000. It appears probable that this sum is sufficient to cover the cost of construction of the proposed works.

The bulk of the piping will be laid in public streets and roads, so that the only land which it is intended to purchase is a lot of about three acres covering the site of the wells and piping station.

Other sources of supply could doubtless be obtained in the district, but they would all be of very similar character and there is little choice between them. There seems no reason to suppose that the selected location is not as good as any other.

The Roosevelt Water Company, village of Freeport, village of Rockville Center and the city of New York take water from underground sources near this district. The city of New York has some wells within the district along the line of the Long Island railroad. It, however, does not appear that the operation of the proposed works of the Baldwin Water Company will materially affect any of these other installations.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment, in order that they may be equitably determined and paid.

From consideration of the above, the commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at the present time unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the Baldwin Water Company is hereby approved and permission to construct the desired works is granted, subject to further inspection by this Commission as provided by section 523 of article 9 of the Conservation Law.

IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany this 6th day of May, 1912.

[L. S.]

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 110.

City of New York — Schoharie creek sources.

Application filed April 2, 1912.

Hearings held June 11 and July 19, 1912.

This petition is made in continuation of water supply application No. 1, in which the city asked for permission to take water from the so-called Catskill sources and water supply application No. 28, in which permission to utilize the watershed of Schoharie Creek as a source of water supply for the city was asked, which application was discontinued upon the request of the city authorities and which is now replaced by this application.

The city desires to build a reservoir on Schoharie creek just above the village of Prattsville and to divert all the flow of the creek above that point into the Ashokan reservoir, now being constructed, and from thence to the city.

Further hearings will be held upon this application.

WATER SUPPLY APPLICATION NO. 111.

STATE OF NEW YORK CONSERVATION COMMISSION.

In the Matter of the Application of the VILLAGE OF GRANDVIEW-ON-HUDSON, for approval of the extension of the mains of the Spring Valley Water Works and Supply Company into the village.	*Decision:*

Petition filed April 3, 1912.

Hearing held in Nyack, May 9, 1912.

Decision May 27, 1912.

Approved.

On April 3, 1912, the village of Grandview-on-Hudson, by its president, filed with the Conservation Commission an application for approval of the proposed extension of the mains of the Spring Valley Water Works and Supply Company into the village, so as to supply water for domestic purposes and fire protection to the inhabitants of the village.

Subsequent to due notice published in the *Rockland County Leader* of Spring Valley, the *Search Light* of Pearl River, the *Rockland County Democrat* and the *Star* of Nyack, a hearing was held in the Town Hall at Nyack, May 9, 1912. At this hearing the Commission considered the petition, maps and plans submitted by the applicant, examined witnesses and heard arguments for and against the project, as shown by the minutes. This hearing was held jointly on this application and the application of the village of Piermont-on-Hudson for the approval of the plans of this village for obtaining a source of water supply from the Spring Valley Water Works and Supply

Company, and the application of the Spring Valley Water Works and Supply Company for extending its existing mains into these villages. The village of Nyack appeared in opposition to these applications.

After due study of the petition and its exhibits, evidence and arguments given at the hearing, it appears as follows:

The village of Grandview-on-Hudson is a municipal corporation, organized under the laws of the State of New York. The population of the village at the present time is estimated as about 400. The Spring Valley Water Works and Supply Company was organized in 1893 to supply water to the village of Spring Valley and has been and is now supplying water for domestic and fire purposes to that village.

At the present time there is no public water supply system within the village. Water for domestic purposes is obtained from private wells and small springs, and there is practically no fire protection.

On the 20th day of September, 1911, the village made a contract with the water company, whereby the said company undertook to extend its mains into the village to establish and maintain fire hydrants and to supply water for the purpose of fire protection.

The water supply of the Spring Valley Water Works and Supply Company is to be obtained from six driven wells in the village of Spring Valley. Pumping tests conducted upon four of these wells seem to indicate that a continuous yield of 2,000,000 gallons per day could be obtained therefrom. The population of the district to be supplied with water by the company, including the village of Spring Valley, is estimated at the present time to be not over 9,000. This would indicate that the maximum consumption for some years to come would not be over 500,000 gallons per day.

Analyses of water from these wells, submitted with the application, indicate that the water is of suitable quality for domestic consumption and that purification will be unnecessary.

Water, as stated above, is to be obtained from six driven wells in the village of Spring Valley. These wells are spaced about 240 feet apart and are from 320 to 400 feet in depth. Water from the wells will be pumped to a reservoir which it is proposed to construct with a capacity of 5,000,000 gallons and a flow line at elevation of 430. From this reservoir the water will be conducted through a 20-inch pipe as far as Pearl river and for the remaining distance to Grandview through a 12-inch pipe. Connecting pipes of various sizes will be laid where necessary to supply consumers.

The village of Grandview does not contemplate the construction of any water supply works, or the acquisition of any land. The village, as a municipality, will deal with the company only in the matter of obtaining water for fire protection. The company will supply water to such of the inhabitants of the village as desire to make connections with its mains and will deal with them directly.

The only obvious alternative source of supply for the village of Grandview is the Hackensack river, which is now used as a source of supply for the village of Nyack, or the Sparkill back of Piermont. Both of these supplies are decidedly contaminated and water from them will have to be pumped in any case. Water from the wells in Spring Valley should be used primarily for the inhabitants of the village of Spring Valley. After them the inhabitants

of the villages of Pearl River and Nanuet would have prior claim. It appears, however, that there is sufficient water to supply all these villages, as well as Grandview, Piermont, Sparkill, Tappan and other sections with water for some years to come, and that, if at a future date it became necessary to enlarge this supply, filtered water from the Hackensack or elsewhere could be pumped into the mains which it is now proposed to lay.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the village of Grandview-on-Hudson is hereby approved and permission to construct the desired works is granted, subject to further inspection by this Commission, as provided by section 523 of the conservation law.

IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 27th day of May, 1912.

[L. S.]

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 112.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the VILLAGE OF PIERMONT-ON-HUDSON, for approval of the extension of the mains of the Spring Valley Waterworks and Supply Company into the village.	*Decision.*

Petition filed April 19, 1912.
Hearing held in Nyack, May 9, 1912.
Decision May 27, 1912.
Approved.

On April 19, 1912, the village of Piermont-on-Hudson, by its board of water commissioners, filed with the Conservation Commission an application for approval of the proposed extension of the mains of the Spring Valley Water Works and Supply Company into the village, so as to supply water for domestic purposes and fire protection to the inhabitants of the village.

Subsequent to due notice published in the *Rockland County Leader* of Spring Valley, the *Search Light* of Pearl River, the *Rockland County Democrat*, and the *Star* of Nyack, a hearing was held in the town hall at Nyack, May 9, 1912. At this hearing the Commission considered the petition, maps and plans submitted by the applicant, examined witnesses and heard arguments for and against the project, as shown by the minutes. This hearing was held jointly on this application and the application of the village of Grandview-on-Hudson for the approval of the plans of this village for obtaining a source of water supply from the Spring Valley Water Works and Supply Company, and the application of the Spring Valley Water Works and Supply Company for extending its existing mains into these villages. The village of Nyack appeared in opposition to these applications.

After due study of the petition and its exhibits, evidence and arguments given at the hearing, it appears as follows:

The village of Piermont-on-Hudson is a municipal corporation, organized under the laws of the State of New York. The population of the village at the present time is estimated as about 1,400. The Spring Valley Water Works and Supply Company was organized in 1893 to supply water to the village of Spring Valley and has been and is now supplying water for domestic and fire purposes to that village.

At the present time there is no public water supply system within the village. Water for domestic purposes is obtained from private wells and small springs, and there is practically no fire protection.

On the 20th day of September, 1911, the village made a contract with the water company, whereby the said company undertook to extend its mains into the village to establish and maintain fire hydrants and to supply water for the purpose of fire protection.

The water supply of the Spring Valley Water Works and Supply Company is to be obtained from six driven wells in the village of Spring Valley. Pumping tests conducted upon four of these wells seem to indicate that a continuous yield of 2,000,000 gallons per day could be obtained therefrom. The population of the district to be supplied with water by the company, including the village of Spring Valley, is estimated at the present time to be not over 9,000. This would indicate that the maximum consumption for some years to come would not be over 500,000 gallons per day.

Analyses of water from these wells, submitted with the application, indicate that the water is of suitable quality for domestic consumption and that purification will be unnecessary.

Water, as stated above, is to be obtained from six driven wells in the village of Spring Valley. These wells are spaced about 240 feet apart and are from 320 to 400 feet in depth. Water from the wells will be pumped to a reservoir which it is proposed to construct with a capacity of 5,000,000 gallons and a flow line at elevation of 430. From this reservoir the water will be conducted through a 20-inch pipe as far as Pearl River and for the remaining distance to Piermont and thence to Grandview through a 12-inch pipe. Connecting pipes of various sizes will be laid where necessary to supply consumers.

The village of Piermont does not contemplate the construction of any water supply works, or the acquisition of any land. The village, as a municipality, will deal with the company only in the matter of obtaining water for fire protection. The company will supply water to such of the inhabitants of the village as desire to make connections with its mains and will deal with them directly.

The only obvious alternative source of supply for the village of Piermont is the Hackensack river, which is now used as a source of supply for the village of Nyack, or the Sparkill back of Piermont. Both of these supplies are decidedly contaminated and water from them will have to be pumped in any case. Water from the wells in Spring Valley should be used primarily for the inhabitants of the village of Spring Valley. After them the inhabitants of the villages of Pearl River and Nanuet would have prior claim. It appears, however, that there is sufficient water to supply all these villages, as well as Grandview, Piermont, Sparkill, Tappan and other sections with water for some years to come, and that, if at a future date it became necessary to enlarge this supply, filtered water from the Hackensack or elsewhere could be pumped into the mains which it is now proposed to lay.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal

corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the village of Piermont-on-Hudson is hereby approved and permission to construct the desired works is granted, subject to further inspection by this Commission, as provided by section 523 of the conservation law.

IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the [L. S.] same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 27th day of May, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 113.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the HARTSDALE WATER DISTRICT of the Town of Greenburgh, county of Westchester, N. Y., for the approval of the engineering and financial plans of its proposed water supply system. } *Decision.*

Application filed April 15, 1912.
Hearing held at Hartsdale, May 20, 1912.
Decision June 4, 1912.
Approved.

On April 15, 1912, the Hartsdale Water District, by its Board of Water Commissioners, filed with the Conservation Commission an application for approval of its proposed acquisition of a source of water supply and of the maps and plans of the water works construction necessary to provide water for domestic consumption and fire protection to the Hartsdale Water District. The site of the proposed works was inspected by one of the engineering staff of this Commission on April 26, 1912.

Subsequent to due notice published in the *Daily Reporter and Eastern States Journal* of White Plains, a hearing was held in the Fire Hall at Hartsdale, May 20, 1912. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. No objectors to the proposed work appeared.

After due study of the petition and its exhibits, evidence and arguments given at the hearing and the report of the Commission's engineer, it appears as follows:

The Hartsdale Water District is a municipal corporation, created, pursuant to the provisions of section 282 of article 13 of chapter 62 of the Consolidated Laws, by an order of the town board of Greenburgh, Westchester county, on November 28, 1911. The Board of Water Commissioners for the district was organized on February 9, 1912. The district is about a square mile in extent and is situated adjacent to and southwest of the village of White Plains along the western side of the tracks of the Harlem division of the New York Central railroad. The population at the present time is estimated as between five and six hundred. The assessed valuation at the time of organization was $807,030 and the liabilities are less than $2,000.

There is at the present time no public water supply within this district. Water for domestic purposes is obtained from driven wells which are in danger of contamination from surface wash and neighboring cesspools, and many of which have become dry during recent dry summers. There is no water available for fire protection, except from these wells and a stream flowing through the village. Several valuable buildings have recently been lost by fire, which apparently might have been saved if an ample supply of water had been available.

The Board of Water Commissioners employed Mr. D. B. Metcalf as engineer and Mr. D. S. Merritt as consulting engineer, to prepare plans for a water supply system for the district. These plans and the reports of the engineers were submitted with the application. Upon the approval of these plans by the Board of Water Commissioners, a petition to this Commission was authorized on March 25, 1912. The amount authorized to be spent on this work is $27,000.

The proposed source of supply for the district is from the water works system of the village of White Plains. White Plains obtains water from two small reservoirs, from certain driven wells belonging to the village and from the Castle Heights Water Company. The present consumption of the village is about one and one-half million gallons per day, of which 750,000 gallons comes from the water company. The village has a contract with the company, by the terms of which they are to be furnished with one million gallons per day; this amount being more than is needed to supply the present consumption of the village, there remains a surplus which can be sold to the Hartsdale Water District. A contract was entered into between the authorities of the village and of the water district on April 9, 1912, by which the village undertook to supply the district with water at the rate of twenty cents per hundred cubic feet of water delivered and five dollars per annum for every fire hydrant installed in the district. This contract is drawn to run for one year.

Analyses of the White Plains water, which were submitted with the application, indicate that it is of suitable quality for domestic purposes. Furthermore, the various sources of supply of the village of White Plains have previously been examined by this Commission and by the State Water Supply Commission and the water has been found to be suitable for domestic use. None of this water is filtered at the present time, but such filtration is not considered necessary.

The village of White Plains is to extend an 8-inch main through Battle avenue to the village boundary, which is also the boundary of the water district. The district will lay cast-iron pipes of various sizes in the various streets and roads of the district, connecting this system through a meter to the 8-inch main from White Plains. Hydrants will be established at suitable intervals and the sizes and distribution of pipes and hydrants and the pressure available from the White Plains standpipe and pumps are sufficient to give fair fire protection.

The estimated cost of the proposed works, as shown by the report of the engineer, is $25,000. This appears to be a fair estimate.

The proposed works, if well constructed of proper materials, will be safe.

All of the piping to be laid in the district will be in public streets or roads, so that no land will be acquired.

Alternative sources of supply for this district have been extensively investigated by the engineers. A 48-inch main from the Kensico reservoir to the Williamsburg district of the Borough of the Bronx runs through the heart of the district. The new Catskill aqueduct of the New York city works lies about one and one-half miles west of the district. The mains of the Consolidated Water Company of Suburban, N. Y., run about two miles south of the district. Any of these sources of supply are now, or might be in the future, available for use with the piping now proposed to be laid. Water from any of these would have to be pumped and the cost would probably be excessive. Water might also be supplied direct from the wells of the Castle Heights Water Company. This was discussed with the authorities of that company, but no satisfactory arrangement could be made. The report of the engineer and the plans submitted show an alternative source of supply from within the district, water to be obtained from wells in the valley of the stream flowing through the district, a small pumping station to be installed near the wells and a suitable standpipe erected near the western boundary. This alternative project is entirely feasible and can be installed readily, if, for any reason, water can no longer be obtained from the village of White Plains.

Water from the Castle Heights wells is used for domestic purposes by the village of White Plains and also by various communities situated between White Plains and Valhalla. These districts might be said to have a claim on the Castle Heights water prior to that of the Hartsdale Water District, but at the present time there is sufficient water for all, and, as above stated, a local supply can be obtained readily if necessary.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the Hartsdale Water District is hereby approved and permission to construct the desired works is granted, subject to further inspection by this Commission, as provided by section 523 of the Conservation law.

IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed [L. S.] the same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 4th day of June, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 114.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the VILLAGE OF WOLCOTT, Wayne county, for approval of its plans for a proposed water supply system. } *Decision.*

Application filed April 22, 1912.
Hearing held in Wolcott, May 23, 1912.
Decision June 4, 1912.
Approved.

On April 22, 1912, the village of Wolcott, by its Board of Trustees, filed with the Conservation Commission an application for approval of its proposed acquisition of a source of water supply and of the maps and plans of the water works construction necessary to provide water for the village for domestic consumption and fire protection. The proposed source of supply for the district was inspected by one of the engineering staff of this Commission on May 14th.

Subsequent to due notice published in the *Lake Shore News* of Wolcott, the *Red Creek Herald* of Red Creek and the *Wayne County Democratic Press* of Lyons, a hearing was held in the fire hall at Wolcott on May 23, 1912. Objections to the project were filed by A. J. Kelley, J. H. Shafer, Bert Bovee, Jefferson Waldorf, R. S. Wadsworth, Joseph Prior and Cora E. Prior, land owners along the streams from which the proposed supply is to be diverted, who were represented by Joel Fanning.

After due study of the petition and its exhibits, evidence and arguments given at the hearing and the report of the Commission's engineer, it appears as follows:

Wolcott is a village, incorporated March 7, 1873, under the provisions of chapter 291 of the Laws of 1870. It is situated in the northeast corner of Wayne county on the Niagara Falls line of the New York Central Railroad. The estimated present population is 1,500; the assessed valuation over $500,000 and the bonded indebtedness about $6,500 — bonds outstanding on the amount originally borrowed to construct a fire hall.

The village of Wolcott is without any public system of water supply or public sewerage system. Water for domestic purposes is obtained from wells, which, in many cases, are in close proximity to cesspools and of doubtful purity. Water for fire protection is obtained from these wells, from cisterns situated in various parts of the town and from Wolcott creek which flows through the village. The quantity of water for purposes of fire protection is entirely inadequate and there have been recent heavy losses from fire in the village, which possibly might have been prevented if an ample supply had been available.

On March 19, 1912, the question of authorizing a bond issue of $45,000, for the purpose of installing a public system of water supply, was submitted to the voters of the village and the proposition was carried by a majority of over one hundred. The Board of Trustees of the village engaged Mr. Charles C. Hopkins as engineer to find a source of water supply and prepare plans and estimates for the construction of the water works system. The maps and plans, estimates and report of Mr. Hopkins were submitted with the application.

The proposed source of water supply for the village is what is known as the Weager spring, situated about a mile and a half from the center of the village in a southeasterly direction. This spring is near the headwaters of a small tributary of Wolcott creek and flows out from the side of a hill of sand and gravel. The flow from this spring was measured last February and at that time amounted to 120,000 gallons per day. At the point of junction of the outlet of the spring with the main stream, which is the point where it is proposed to intercept the water, there was, on the same day, a flow of 360,000 gallons per day. At the time of making these measurements the ground was frozen and the neighboring streams were very low. It is said that the spring has never been known to dry up, although the stream, above mentioned, is at times almost dry. The probable consumption of the village would not be over 75,000 gallons per day. If the demands of the village come to exceed the yield of the spring and stream at this point, the supply can be augmented by the construction of a small storage reservoir, or by connecting various similar springs in the neighborhood to the proposed works.

Analyses of the water from the spring, which were submitted with the application, indicate that the water is decidedly hard, but is otherwise suitable for domestic consumption. An inspection of the neighborhood of the spring does not show any source of pollution which would cause serious danger to the purity of the water. It is the intention of the village to buy a small area of land immediately surrounding the spring and fence it to prevent the entrance of cattle thereon.

It is proposed to construct a small diverting dam across the stream at the junction with it of the outflow from the spring, from thence the water will be conducted through an 8-inch cast-iron pipe to a reservoir near the village limits. This reservoir is to be circular, seventy feet inside diameter, with concrete walls and will have a capacity of 300,000 gallons. Near the reservoir it is proposed to install a pumping station, containing two pumping units — one of 200,000 gallons for ordinary purposes and one of 800,000 gallons for emergency use. Probably, at least one of these will be driven by electric power and the other by gasoline or oil. These pumps will force water from the reservoir into a standpipe erected on the nearby hill. This pipe is to be of steel, fifteen feet in diameter and eighty-five feet high, with a capacity of 106,000 gallons. Its top will stand 125 feet above the intersection of Main and New Hartford streets. From the standpipe water will be conducted through cast-iron pipes of various sizes throughout the built-up section of the village. Fire hydrants will be provided at intervals. The sizes and arrangement of the various proposed structures appear to be proper and suitable to supply a sufficient quantity of water for domestic use and also to give adequate discharge and pressure for fire protection.

The estimated cost of these works, as shown by the report of the engineer, is $42,156, exclusive of land damages and legal expenses. This estimate appears to be fair, so that apparently the works can be constructed at a cost within the limits of the appropriation.

The works, if constructed according to the design submitted with good materials and careful workmanship, should be safe.

Land is to be acquired around the spring and intake dam, for a right of way for the pipe line from intake dam to the reservoir, from the reservoir to Auburn street and also two small parcels of land for the reservoir and standpipe, and also from Auburn street to the standpipe; the remainder of the piping will all be laid in village streets or public roads.

Numerous alternative sources of supply have been investigated by the engineer, as shown by his report. No gravity source of supply is available within reasonable distance, and of the numerous springs and small streams in the neighborhood, the Weager spring appears to be the most suitable. Wolcott creek, which flows through the village, is the most obvious source of water supply, but there is a possibility that the water in this creek might be unsatisfactory from a sanitary standpoint. It would have to be pumped through a greater vertical distance than the water from the Weager spring and the diversion of this water would injure various small water powers on the stream, notably one directly in the village. This source of supply, nowever, can be utilized in the future by the installation of another pumping station, the standpipe and distribution piping of the present project being continued in use.

The proposed source of supply is not now used as a source of water supply by any other civil subdivision of the State, and there seems no immediate prospect that any system of water supply works will be established in the near neighborhood for many years to come.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the village of Wolcott is hereby approved and permission to construct the desired works is granted, subject to further inspection by this Commission, as provided by section 523 of the Conservation Law.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 4th day of June, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 115.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the SPRING VALLEY WATER WORKS AND SUPPLY COMPANY for the approval of its plans involving extension of its present system from Spring Valley, Ramapo township, Rockland county, N. Y., to the villages of Piermont and Grandview in Rockland county.	*Decision.*

Petition filed April 27, 1912.
Hearing held in Nyack, May 9, 1912.
Decision May 27, 1912.
Approved.

On April 27, 1912, the Spring Valley Water Works and Supply Company, by its president, filed with the Conservation Commission an application for approval of its proposed extension of its system now existing in the village of Spring Valley into and through the townships of Clarkstown and Orangetown, so as to supply water for domestic purposes and fire protection to the inhabitants of the villages of Grandview and Piermont and of other villages and districts in these townships along the route of the proposed mains.

Subsequent to due notice published in the *Rockland County Leader* of Spring Valley, the *Search Light* of Pearl River, the *Rockland County Democrat* and the *Star of Nyack*, a hearing was held in the town hall at Nyack, May 9, 1912. At this hearing the Commission considered the petition, maps and plans submitted by the applicant, examined witnesses and heard arguments for and against the project, as shown by the minutes. This hearing was held jointly on this application and the applications from the villages of Piermont-on-Hudson and Grandview-on-Hudson, for the approval of the plans of these villages for obtaining a source of water supply from the Spring Valley Water Works and Supply Company. The village of Nyack appeared in opposition to these applications.

After due study of the petition and its exhibits, evidence and arguments given at the hearing, it appears as follows:

The Spring Valley Water Works and Supply Company is a domestic corporation, organized under the laws of the State of New York by a certificate of incorporation duly filed and recorded in the clerk's office of Rockland county on January 31, 1893. The original capital of the company was $10,000. The company was organized to supply water to the village of Spring Valley and has been and is now supplying water for domestic and fire purposes to that village.

At the present time there is no public water supply system within the district through which it is proposed to extend the mains of the company,

nor is there any such system in either of the villages of Grandview or Piermont. Water for domestic purposes is obtained from private wells and there is no fire protection.

The water supply of the company is to be obtained from six driven wells in the village of Spring Valley. Pumping tests conducted upon four of these wells seem to indicate that a continuous yield of 2,000,000 gallons per day could be obtained therefrom. The population of the district to be supplied with water, including the village of Spring Valley, is estimated at the present time to be not over 9,000. This would indicate that the maximum consumption for some years to come would not be over 500,000 gallons per day.

Analyses of water from these wells, submitted with the application, indicate that the water is of suitable quality for domestic consumption and that purification will be unnecessary.

Water, as stated above, is to be obtained from six driven wells in the village of Spring Valley. These wells are spaced about 240 feet apart and are from 320 to 400 feet in depth. Water from the wells will be pumped to a reservoir which it is proposed to construct with a capacity of 5,000,000 gallons and a flow line at elevation of 430. From this reservoir the water will be conducted through a 20-inch pipe as far as Pearl River and for the remaining distance to Grandview through a 12-inch pipe. Connecting pipes of various sizes will be laid where necessary to supply consumers.

The company now owns the land in which the wells have been sunk. Most of the piping is to be laid in public streets and roads, but it is possible that it may be necessary to acquire land for the construction of the reservoir.

The only obvious alternative source of supply for the villages of Grandview and Piermont is the Hackensack river, now used as a source of supply for the village of Nyack, or the Sparkill back of Piermont. Both of these supplies are decidedly contaminated and water from them will have to be pumped in any case. Water from wells in Spring Valley should be used primarily for the inhabitants of the village of Spring Valley. After them, the inhabitants of the villages of Pearl River and Nanuet would have prior claim. It appears, however, that there is sufficient water to supply all these villages, as well as Grandview, Piermont, Sparkill, Tappan and other sections, with water for some years to come, and that, if at a future date it became necessary to enlarge this supply, filtered water from the Hackensack or elsewhere could be pumped into the mains which it is now proposed to lay.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby and of the

inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans.

Therefore, upon the above grounds, the application of the Spring Valley Water Works and Supply Company is hereby approved and permission to construct the desired works is granted, subject to further inspection by this Commission, as provided by section 523 of the Conservation Law.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused its determination and approval to be signed by the Commission and has caused its official seal to be affixed thereto, and has filed the same with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 27th day of May, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 116.

Village of Mt. Morris, Livingston County, N. Y.

Application filed May 11, 1912.

Hearings held June 20, July 11 and September 10, 1912.

The village of Mt. Morris applied for approval of its plan of installing a complete municipally owned and operated water supply system, water for which is to be obtained by gravity from Silver lake. It is proposed to filter this water before delivering it to the mains.

The Mills Water Works Company is now operating in this village. It obtains its water from springs and a system of tile collecting drains near the village.

Three hearings have been held, but the Commission has not yet made its decision in this matter.

WATER SUPPLY APPLICATION NO. 117.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter
of the
Application of the BOARD OF WATER COMMISSIONERS OF THE VILLAGE OF PEEKSKILL to have the Conservation Commission approve of the construction of a storage reservoir in connection with the water supply system of said village.

Decision.

Application filed May 14, 1912.

Hearings held at Peekskill June 18 and July 10, 1912.

Decision July 31, 1912.

Approved.

The board of water commissioners of the village of Peekskill, by Allan L. Sutton, president, on May 11, 1912, made application to the Conservation Commission for approval of its plans for the construction of a storage reservoir on Stillwater brook, in order to augment the water supply of the village. This application was filed with the Conservation Commission May 14, 1912. On May 10th and June 17th the Commission caused the present waterworks system and site of the proposed construction to be inspected by its engineers.

After due notice published in various papers of Westchester and Putnam counties, a hearing was held upon this application in the municipal building of the village of Peekskill, June 13, 1912, and this hearing was adjourned to July 10th in the same place. At these hearings the board of water commissioners were represented by their president and Messrs. Edward J. Wilson and Nathan P. Bushnell, attorneys. In opposition to the application appeared John V. Alexander of Peekskill in person and represented by Marvin R. Smith, his attorney; city of Yonkers, represented by Max Cohen, assistant corporation counsel; the Chamber of Commerce of the city of Mt. Vernon, represented by Joseph S. Wood. In addition to these an objection was filed by the Ramapo Water Company, but this company was not represented at the hearing. The Westchester County Chamber of Commerce, represented by Herbert G. Angell, also appeared and filed a statement asking that due consideration be given to the rights of Westchester county considered as a whole. At these hearings the Commission considered the petition, maps and plans submitted, examined witnesses, and heard arguments for and against the project, as shown by the minutes.

After due study of the petition and accompanying exhibits and of the evidence and arguments given at the hearings, it appears as follows:

Peekskill is an incorporated village in Westchester county. The board of water commissioners of the village of Peekskill was created by chapter 231 of the Laws of 1872, and acts also under the provisions of chapter 118 of the Laws of 1909. The village of Peekskill has a population of about

16,000 persons. The assessed valuation is $7,883,000, and the total outstanding indebtedness of the village for water bonds is $374,436.18.

The village of Peekskill at present obtains its water by pumping from Peekskill Hollow creek. The quantity of water available for use is limited by the capacity of the pumping plant and by the minimum low water flow of the stream. At the present time the village owns no storage reservoirs upon Peekskill creek or any of its tributaries. The pumping station is operated partly by water power and partly by steam, and in emergencies by electricity. The limiting pumping capacity is that of the steam unit, 3,000,000 gallons per day. The electrically operated pump has a capacity of 1,000,000 gallons per day, but is used only in emergency. Water is pumped from the creek to a distributing reservoir of 8,000,000 gallons capacity, with its maximum water level 376 feet above high water in the Hudson. From this reservoir water flows by gravity through a recently constructed slow sand filtration plant, of 4,000,000 gallons per day capacity to the village. A portion of the filtered water is pumped by an electrically driven centrifugal pump, of 1,444,000 gallons capacity, to a high pressure stand pipe of 400,000 gallons capacity, with a maximum elevation of water surface of 600 feet above the village.

The waters of Peekskill creek are contaminated, and without filtration would be unsuitable for domestic consumption. The filters were recently installed as a result of an epidemic of typhoid fever caused by the contamination of the waters of the creek. These filters are of an effective type and appear to be giving an effluent of a high degree of purity.

During recent dry summers the minimum low water flow of Peekskill creek has not been sufficient to supply the consumption of the village, amounting to two and one-half to three million gallons per day. In order to prevent shortage, waters stored in Oscawana lake were drawn upon and allowed to run down the natural bed of the creek to the pumping station. The village does not control this lake, and recent legislation has provided that the board of water commissioners cannot acquire any rights in this lake.

As it appeared to be essential that the village should acquire or build a storage reservoir to augment the low water flow, the electors of the village were asked to vote upon a proposition to issue bonds to the amount of $95,000 to finance the necessary construction. This election was held on July 3, 1911, and the proposition was carried.

The Board of Water Commissioners in person, and their engineer, Isaac W. Reynolds, investigated several proposed reservoir sites, and it was finally decided to build a storage reservoir on Stillwater brook, a stream which joins Peekskill Hollow creek near the hamlet of Tompkins Corners. On this brook the applicant desires to build two storage reservoirs, as shown by the maps submitted, but it is proposed to defer the construction of the upper one until some future period, at which time detailed drawings will be submitted to this Commission for approval. The lower reservoir, which it is now proposed to construct, will be formed by the construction of a concrete dam, founded on rock, at a favorable location at the lower end of a somewhat extensive basin. This basin has rock sides, and a nearly level floor, now covered by a swamp apparently composed of a considerable depth of muck.

The capacity of this reservoir is to be 450,000,000 gallons and the maximum flow line 720 feet above sea level.

It is not proposed to draw from this reservoir except in time of emergency, when the water will be allowed to flow from it down the present natural channels to the present pumping station. A study of the records of rainfall and run-off on the adjacent Croton watersheds indicates that it will be possible to fill this reservoir at least one and one-half times during any year not drier than the driest on record. It is probable that this quantity of water will be sufficient for the needs of the village for some years to come.

In all probability during warm weather, when the water level has been considerably reduced, the water in this reservoir will be colored, will contain vegetable growths, and may have some odor. It is probable that water drawn directly from the reservoir during such seasons would be undesirable for domestic consumption, but this water will purify itself to a considerable extent by aeration while flowing from the reservoir to the intake of the pumping station, and by the time it has been passed through the sand filtration plant of the village all undesirable elements will have been removed from it, except possibly some of the color.

The estimate of the cost of the proposed works, as submitted by the engineer of the village, appears to be reasonable, and the works can probably be constructed in an efficient manner within the limits of the appropriation.

The works, if constructed of good material and with careful workmanship, in accordance with the revised plans, will be safe.

It is proposed to acquire land sufficient for both the proposed storage reservoirs on Stillwater brook, and also additional land for the protection of the water supply from contamination, amounting in all to 431 acres. In addition, it will be necessary to acquire certain water rights in Stillwater brook below the dam.

Various alternative sources of supply exist and could be used. At least four reservoir sites have been investigated by various persons upon Peekskill Hollow creek, and there are numerous other available sites on the tributary streams. It is possible that the proposed reservoir can be more cheaply constructed than any other.

At the present time Peekskill creek is used as a source of water supply only for the village of Peekskill. The total available yield of this creek is greater than will be required by the village for many years to come, and this surplus yield is the natural and proper source of supply for the southerly portion of Westchester county, and it is practically the only source of supply for that section, excluding the New York city water supplies, which can be made available by gravity and which lies within a reasonable distance, with the exception of Popolopen creek on the west bank of the Hudson. The taking of water from Peekskill creek has been contemplated and investigated by the city of Yonkers, the city of Mount Vernon, and also by the State Water Supply Commission, as a source of supply for the whole of Westchester county. It was also investigated by the city of New York as a possible temporary source of water supply, pending the completion of the Catskill works. For the purpose of supplying Westchester county, the upper portion of Stillwater brook, which the village of Peekskill now desires to utilize, has certain great advantages on account of its high elevation, which

advantage of head is not to be utilized by the village of Peekskill as long as the present system of pumping water is continued, and it appears further that owing to the elevation of the filter plant that the installation of a complete gravity supply for that village from Peekskill Hollow creek is impracticable at present.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

In consideration of the above the Commission, therefore, finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and watershed from contamination, in view of the fact that they provide for the proper filtration of such additional supply.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby, and to the inhabitants thereof, particular consideration being giving to their present and future necessities for sources of water supply, except that there are certain municipalities in Westchester county which, if they so desire, should justly and equitably be allowed to participate in the use of this supply and of these proposed reservoirs, even to the extent of excluding the village of Peekskill from the use thereof, unless the water supply system of that village shall have been rearranged.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

THEREFORE, upon the above grounds, the application of the Board of Water Commissioners of the village of Peekskill for permission to construct the desired works, subject to further inspection by this Commission as provided by section 523 of the Conservation Law, and to use and operate the same, is granted, until such time as some other municipality in Westchester county wishes to participate in this use and operation and the acquisition of the necessary land is approved for use under the above limitations.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto, and has filed the same, with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 31st day of July, 1912.

[L. S.]

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 118.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the VILLAGE OF FAYETTEVILLE, Onondaga county, N. Y., for the approval of its plans to purchase lands and construct thereon an additional storage reservoir.	*Decision.*

Application filed May 27, 1912.
Hearing held at Fayetteville, July 2, 1912.
Decision July 31, 1912.
Approved.

By authority of a resolution of the Board of Trustees at a meeting held May 22, 1912, the village of Fayetteville, by Wilbur M. Jones, village president, made application to the Conservation Commission on May 23, 1912, for approval of its proposed purchase of lands for the protection of its source of water supply and for the construction of an additional storage reservoir and of the plans of this reservoir. This petition was filed with the Conservation Commission May 27, 1912. On June 21 and July 2, 1912, the Commission caused the site of the proposed works and of the source of water supply to be inspected by its engineers.

After due notice published in the Syracuse *Herald* and the Fayetteville *Bulletin*, a hearing was held on this petition in Everingham Hall in the village of Fayetteville at 10:30 A. M., July 2, 1912. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. No objections to the granting of the application were filed.

After due study of the petition and its exhibits, evidence and arguments given at the hearing, it appears as follows:

Fayetteville, which forms a part of the town of Manlius, Onondaga county, was duly organized and exists as an incorporated village under the Village Law. At the time of the last federal census, the population of the village was 1,481, and it is estimated at present to be over 1,500. The assessed valuation at the time of the last roll was $522,810. Bonds are outstanding in the amount of $29,000, issued in 1892 for the construction of the water system. Notes are outstanding for $1,500 and the sinking fund amounts to $5,400.

Fayetteville at the present time has a municipal system, supplying water for domestic purposes and fire protection. This system was constructed in 1892-3. Water is obtained from a spring or springs some two miles east of the village, which formerly was the source of Pool's brook, a tributary to Chittenango creek. This spring is of large volume, issuing from limestone rock. Analyses of the water made by the State Department of Health and a local inspection of the spring and surrounding country, indicate that this water, although decidedly hard, is of good quality for domestic consumption. The yield has not been accurately measured, but that portion of it which is

intercepted is just about sufficient to supply the demands of the village of Fayetteville in the driest weather. A certain portion of the yield of this spring has not been intercepted by the village.

The original waterworks construction intercepted the flow from this spring at several points and from thence carried the water to the village by gravity. Mains, pipes and fire hydrants were provided in the streets in the usual manner. A reservoir of 1,200,000 gallons capacity was constructed near the springs and connected directly with the supply main. All of the spring water that has been intercepted, and which has not been used immediately by the village, has been discharged into this reservoir and overflowed therefrom into another branch of Pool's brook.

The original storage reservoir is depended upon to furnish fire protection for the village, the rate of fire draft being considerably in excess of the rate of yield of the spring. There is no other stand-pipe or reservoir to furnish water for fire protection. During the recent dry summers the consumption at times slightly exceeded the yield of the spring, so that it became necessary to draw upon the water stored in the reservoir, thus reducing the water available for fire purposes and increasing the fire risk.

In order to make available a larger proportion of the yield of these springs, in view of the probable increased consumption due to the proposed installation of a sewarage system, to have a larger volume of water in reserve for fire protection and to give opportunity to clean the present reservoir without sacrificing all stored water, the village board decided to construct another storage reservoir and also to purchase about twenty-eight acres of land covering the site of this reservoir and the territory immediately surrounding the source of water supply. To obtain funds for this purpose, a special election was held in the village on April 1, 1912, and a proposition submitted to the electors to issue village bonds to the extent of $15,000 for the above mentioned purposes. This election was duly carried.

Plans for the proposed construction were made by C. W. Knight, engineer for the village, and were submitted with this application. These plans were later modified and in their final form filed July 22, 1912, they show that the reservoir is to be formed by earth embankments having slopes of one on two, the inner slope being paved, and having a puddle core wall in the center of the embankment. The capacity of this reservoir to be something less than 9,000,000 gallons. This reservoir to be connected with the old reservoir and with the pipe lines in such a manner that the water stored in it will always be available for fire protection and for domestic consumption in times of excessive draft.

It appears that the estimated cost of the works is reasonable and that the reservoir can probably be constructed within the limits of the appropriation. If well built of proper materials, the reservoir will be safe.

The necessary land has already been purchased. It comprises one parcel of 27.66 acres in extent, covering the site of the new reservoir and the land between the new and the old reservoir and the old reservoir and the spring. The village has already acquired the right to all the water from this spring.

There are no other municipal corporations situated on Pool's brook between the spring and the Erie canal, and it does not appear that any other civil subdivision of the State takes, or is likely to take, water from this brook for purposes of domestic water supply.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

From consideration of the above, the Commission, therefore, finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for proper and safe construction of all work connected therewith.

Third. That said plans provide for proper protection of the supply from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipal corporations and civil divisions of the State affected thereby, and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provision for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission, and has caused its official seal to be affixed hereto, and has filed the same, with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 31st day of July, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 119.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the VILLAGE BOARD OF PORT LEYDEN, Lewis County, N. Y., acting as water commissioners of said village, for permission to obtain and install an additional water supply. } *Decision.*

Application filed June 7, 1912.

Hearing held at Port Leyden, July 15, 1912.

Decision September 10, 1912.

Approved.

The village of Port Leyden, by its board of trustees acting as a board of water commissioners, on the 5th day of June, 1912, made application to the Conservation Commission for approval of its proposed taking of an additional

source of water supply, of the plans of the necessary construction in connection therewith and of the acquisition of the necessary land. This application was filed with the Conservation Commission June 7, 1912. On June 29, 1912, the Commission caused the proposed source of water supply and the site of the proposed works to be inspected by one of its engineers.

After due notice, published in the Port Leyden *Enterprise* and the *Herald and Democrat* of Lowville, a hearing was held on this petition in the engine house of the village of Port Leyden on the 15th day of July, 1912, at 11.30 A. M. At this hearing the petitioner was represented by D. H. O'Brien, village attorney, and William H. Burke, village president. Objections to the proposed scheme were filed by Homer E. Wilson, who appeared in person, and by his attorney, J. F. de La Fleur. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for and against the project, as shown by the minutes.

After due study of the petition and its exhibits, the evidence and the arguments given at the hearing and the report of its engineer, it appears as follows:

Port Leyden is a village in Lewis county, lying in the towns of Leyden and Lyonsdale. It was incorporated in 1871 and had a population in 1910 of 886 persons and an assessed valuation at the time of the last roll of $200,715.

The village at present has a municipal water supply system, water being obtained from the headwaters of a branch of Cold brook, 2½ miles due east of the village. A small reservoir has been constructed on this stream which impounds water for purposes of fire protection. The water tributary to this reservoir is practically all spring water, flowing from the base of an extensive sand hill. From the reservoir water is led through cast-iron pipes to the village and distributed through the streets. Fire hydrants are provided at suitable intervals and the pressure is ample for purposes of fire protection. There is no standpipe or reservoir other than that above described.

The yield of the present source of supply at times of lowest water is almost equal to the present consumption of the village, but of late years, in very dry summers, it has been found necessary to deplete the storage of the reservoir to a certain extent in order to supply the normal draught, so that at times the village has been left without fire protection other than the low water flow of the spring, which is entirely inadequate for the purpose. The reservoir needs to be cleaned out periodically and in order to do so it is necessary to empty it. After such cleaning it takes a week or more to fill the reservoir and during this period the village is without fire protection.

In order to meet the probable increase in consumption, to provide fire protection at all times and to permit the cleaning of the present reservoir without interfering with the delivery of water to the village, the board of trustees decided that an additional reservoir and source of supply was necessary.

On May 29, 1912, a proposition was submitted to the electors of the village to acquire such an additional supply, to issue bonds to the amount of $3,000 and to expend $2,000, now in the water fund, for the acquisition of such a supply and the necessary land and to build a reservoir and connecting piping. This election was carried by a large majority.

The board of trustees engaged Sidney S. Snell as engineer, and under their direction he prepared plans and estimates of the new reservoir and pipe

lines; these plans and estimates were submitted with the petition and were afterwards revised.

The proposed additional source of supply is the headwaters of the northerly branch of the creek now used. A small reservoir is to be constructed near the headwaters of this brook where the water tributary to it will be spring water, similar to that already in use. The new reservoir is to have a capacity of 200,000 gallons with a flow line at the same level as that of the present reservoir. About 3,200 feet of piping will be laid from this reservoir to a connection with the existing main, which was placed there for the purpose at the time of the original construction. It is expected that the construction of the proposed works will approximately double the available water both for domestic purposes and for fire protection. It will also permit of the cleaning, repair and reconstruction of one reservoir while the other is supplying the needs of the village.

Analyses of the water from the proposed additional source of supply indicate some contamination from animal sources, but inspection of the territory surrounding the springs shows that this is probably from the pasturing of cattle and shows little or no danger of pollution from human sources, and it appears that this water ought to be suitable for domestic consumption if the spring and surrounding lands are properly cleaned up. It is proposed to buy and fence land around the springs, reservoir and connecting stream.

The engineer estimates that the proposed works will cost approximately $3,900. It seems that this estimate is reasonable and that it ought to be possible to construct the works without exceeding the appropriation voted at the recent election.

The works, if built according to the amended designs filed August 28, 1912, with good workmanship and proper materials, will be safe.

It is proposed to acquire 5.15 acres of land surrounding the springs and the new reservoir. In addition to this 3,000 feet of right of way for the pipe line will be acquired.

A study of the maps of this district fails to show any alternative source of supply which will be as good or better than that proposed.

The execution of the plans of the village of Port Leyden will not adversely affect the interests of any other civil subdivision of the State or the inhabitants thereof.

The legal damages which may be caused by the execution of the plans of the petitioner do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

In consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and the watershed from contamination and that filtration is at the present time unnecessary.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof,

particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

Therefore, upon the above grounds, the application of the village board of Port Leyden is hereby approved and permission to acquire the above land and to construct and operate the above works is granted, subject to further inspection by this Commission as provided by section 523 of the Conservation Law.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto and has filed the same with all maps, plans, reports and other papers relating thereto in its office in the city of Albany this 10th day of September, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 120.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter
of the
Application of the ROCHESTER AND LAKE ONTARIO WATER COMPANY, for permission to extend its mains into the town of Irondequoit.
} *Decision.*

Application filed June 13, 1912.
Hearing held at Rochester, July 13, 1912.
Decision July 31, 1912.
Approved.

The Rochester and Lake Ontario Water Company, by its vice-president and general manager, acting by authority of the board of directors, on June 11, 1912, made application to the Conservation Commission for approval of the proposed extension by the company of its mains into the town of Irondequoit, Monroe county, for the purpose of supplying the inhabitants of that township with water for domestic purposes and fire protection. This application was filed June 13, 1912, and on May 24, 1912, the Commission caused Irondequoit township and the present works of the company to be inspected by one of its engineers.

After due notice published in the *Democrat and Chronicle*, *Herald*, *Post Express*, and *Union and Advertiser*, all of Rochester, a hearing was held on this application in the rooms of the chamber of commerce in the city of

Rochester on July 13, 1912, at 10 A. M. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. No objections to the granting of the application were filed.

After due study of the petition and its exhibits, the evidence and the arguments given at the hearing, it appears as follows:

The Rochester and Lake Ontario Water Company was organized under Article VII of the Transportation Law of the State of New York in 1902. The authorized capital stock of the company is $2,500,000, all of which has been issued. The authorized bonded indebtedness is $2,500,000, of which $1,562,000 has been issued and is outstanding. The company was organized to furnish water for domestic and other purposes in the towns of Greece, Gates and Brighton and the villages of Brighton and Fairport in the county of Monroe. Since its organization, the company has furnished water to the inhabitants of the above enumerated towns and villages and has extended its mains, until it is now supplying in addition the villages of Penfield, Pittsford and East Rochester and the territory contiguous thereto.

The township of Ironedquoit lies northeast of the city of Rochester, being bounded by Irondequoit bay, Lake Ontario and the Genesee river. The present population is estimated at about 3,750. There is no system of public water supply within the township, except in the Summerville water district, located in the angle between the lake and river, which is now supplied with water by the village of Charlotte, on the opposite bank of the Genesee. The inhabitants of this township desire to obtain water for domestic purposes, fire protection and irrigation and many of them have signed contracts to take water from this company if the mains are so extended.

The plant of the water company consists of a pumping station, located on the shore of Lake Ontario about 1¼ miles west of the mouth of the Genesee river. A 24-inch intake extends into the lake for a distance of 4,000 feet. From the land end of this pipe water is raised by a low lift pump into a sedimentation basin of 430,000 gallons capacity. From this basin water is pumped through filters into the mains. The pumping equipment consists of two steam-driven units of 3,000,000 gallons per day capacity each, now in operation, and one motor-driven unit now being installed, which is to have a capacity of 6,000,000 gallons per day. All the water is filtered by eight Ladue filters — a pressure filter similar to the New York pattern — the total capacity of the filters being 4,000,000 gallons per day. Sulphate of alumina is used as a coagulant and in some cases calcium hypochlorite is also used to reduce the bacterial content of the filtered water. From the filters, the water is forced through various pipes and mains to the districts which are now served. A reservoir of 2,640,000 gallons capacity is connected with this system, being situated on Cobb's Hill near the new reservoir of the Rochester water works; the elevation of this reservoir is 640 feet above sea level.

At the present time this company is pumping approximately 3,500,000 gallons per day. The consumption of Irondequoit township is estimated at 400,000 gallons per day upon the establishment of the works, and it is believed that within two years it will increase to 1,000,000 gallons per day.

Various analyses submitted with the application indicate that the filters are giving an effluent of reasonable purity and that this water is suitable for purposes of domestic consumption.

It is proposed to extend mains and pipes from an existing main in the former village of Brighton, not far from the Cobb's Hill reservoir, through various portions of the town of Irondequoit, extending these from time to time as required. All these mains and pipes will be laid in public streets and roads and it will not be necessary to acquire any land.

No convenient sources of supply for this township, other than Lake Ontario, appear from a study of the maps. The sources of supply of the city of Rochester are so situated as to be available, but the present yield is hardly more than sufficient for the demands of the city itself.

As it appears that the present plant of the company is sufficiently large to supply the town of Irondequoit in addition to those districts which it is already supplying and that the pumping and filtering capacity of this plant could readily be extended, it does not appear that the granting of this application will injuriously affect any other civil subdivision of the State.

The legal damages which may be caused by this work do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

In consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and the watershed from contamination and for the proper filtration of such supply.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

Therefore, upon the above grounds, the application of the Rochester and Lake Ontario Water Company is hereby approved and permission to construct and operate the above works is granted, subject to further inspection by this Commission as provided by section 523 of the Conservation Law.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto and has filed the [L. S.] same with all maps, plans, reports and other papers relating thereto in its office in the city of Albany this 31st day of July, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 121.

Village of Briarcliff Manor, Westchester county.

Petition filed June 22, 1912.

The petition asked for approval of the plan of constructing an impounding and distribution reservoir as extensions to the present water supply system of the village. This application was incomplete, in that the construction of the proposed works had not been authorized by a vote of the electors of the village. Therefore, no further steps will be taken in the matter until such election had been had.

WATER SUPPLY APPLICATION NO. 122.

In the Matter of the Application of the SODUS WATER DISTRICT for approval of its plans for a water supply.	*Decision.*

Application filed July 9, 1912.

Hearing held at Sodus, July 24, 1912.

Decision September 10, 1912.

Approved.

The Board of Water Commissioners of the Sodus Water District on July 6, 1912, made application to the Conservation Commission for approval of the taking of a source of water supply and of the plans of the proposed water supply system for the district. This petition was filed with the Conservation Commission, July 9, 1912. On July 20, 1912, the Commission caused the site of the proposed works and the proposed source of water supply to be inspected by one of its engineers.

After due notice published in the *Wayne Democratic Press* of Lyons and the *Democratic Herald* of Clyde, a hearing was held on this petition in the Fire Hall of the village of Sodus on July 24, 1912, at 1 P. M. At this hearing the petitioner was represented by Myric M. Kelly, Attorney, and Chester W. Conant, Millard F. Boyd and Herman L. Kelly, Water Commissioners for the district, in person. No one appeared in opposition to the proposed plans. At this hearing, the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes.

After due study of the petition and its exhibits, the evidence and the arguments given at the hearing, it appears as follows:

Sodus water district forms a part of the town of Sodus, Wayne county. It covers the unincorporated village of Sodus and has practically the same limits as existing fire and lighting districts. This district was formed by an order of the Town Board of Sodus on April 9, 1912, acting under the provisions of sections 282 and 283 of the Town Law, this action being taken pursuant to a petition signed by the majority of the taxpayers of the district, which was filed with the Town Board, March 28, 1912. The popu-

lation of the district was 1,250 in 1910 and is now estimated at 1,350; the assessed valuation of property within its limits is $438,116 and the only bonded indebtedness is that of the school district, amounting to $6,000. The order of the Town Board authorized a bond issue of $30,000 for the purpose of water works construction.

Sodus water district is at present without any public water supply system. Water for domestic purposes is obtained from wells, nearly all of the driven type. Water for fire protection is taken from a few dug wells and some cisterns in various parts of the village. Water for this purpose is very scarce, as it is impossible to pump from the driven wells with the fire apparatus and it is impossible to get the suction hose into many of the private cisterns. It is frequently necessary to carry water by hand to an iron tub into which the suction hose is led. There have been serious losses from fire within recent years, which it is believed might have been prevented if an ample quantity of water had been available.

Plans for the proposed water works for the district were prepared for submission to the Town Board by Mr. H. C. Kittredge. The Water Commissioners, when they were appointed, engaged Mr. W. A. Lafler as their engineer, and plans prepared by both of these engineers were submitted or offered in evidence. These plans were subsequently revised.

The proposed source of supply is the so-called Cleveland spring, one and one-half miles south of the village. This spring lies in the center of an extensive flat bottomed basin among the hills, is surrounded by marshy ground and is not far from an extensive swamp. The water apparently comes from a bed of cemented gravel which is overlaid by several feet of clayey material. Three gagings have been made of the yield of this spring as follows:

March 5, 1912	107,000 gallons.
Last week in May, 1912	192,000 gallons.
July 24, 1912	86,000 gallons.

It appears that the yield from this spring probably will be sufficient to supply the needs of the district forsome time to come and that, when necessary, additional supplies of water can be obtained in the same general neighborhood and at no very great distance.

Analyses of the water from this spring were submitted with the application, which indicate that, if properly protected from surface wash and from direct contamination by the pasturage of cattle, the water will be suitable for domestic consumption. It is proposed to acquire the land about the spring and fence it to prevent the entrance of cattle. If this area proves insufficient for the purpose, more land will be taken.

It is proposed to construct at the spring a collecting basin, below the level of the ground, fourteen feet in diameter and nine and one-half feet deep, holding approximately 11,000 gallons; this is to be constructed of concrete and to be covered. Immediately adjacent to the basin a pump house is to be built, which will be provided at the present time with one pumping unit of 200,000 gallons per day capacity, operated either by gasoline or electric power. Water will be pumped to a distribution reservoir to be built on McCarty's Hill, three-quarters of a mile west of the village. This reservoir is to be formed by concrete walls backed by an earth embankment, floored

with concrete and covered by a wooden roof. It is to be sixty-eight feet in diameter, twelve and one-half feet deep and have a capacity of 28,000 gallons. The elevation of the flow lines of the collecting basin and distribution reservoir are respectively 418 and 591.5. From the distribution reservoir water is to be distributed by pipes and mains laid in the streets in the usual manner. Hydrants with double 2½-inch nozzles are to be provided at intervals sufficient to give proper fire protection. The pressures in the mains will run from seventy-two to thirty pounds, averaging about sixty-five pounds, and these pressures and the proposed sizes of pipes are sufficient to give adequate fire protection.

The engineer's estimate of the cost of these works is $28,581.30. This estimate appears to be reasonable, although not liberal, and it is believed that with economy the works can be constructed within the limits of the money appropriated.

The proposed works, if carefully constructed in accordance with the revised plans and with good materials, will be safe and efficient. The Commission believes, however, that the installation of a duplicate pumping unit in the near future will be advisable.

It is proposed to acquire title to a parcel of land, surrounding the spring and large enough to permit of the construction of a pumping station, containing 0.46 acres. Another parcel of seven acres is to be taken on McCarty's Hill for the construction of the distribution reservoir; a right of way for the pipe lines from the nearest street to the reservoir, 33 feet wide and 590 feet long, is also to be acquired; the remainder of the piping will be laid in the village streets. It is expected that this land can be acquired by private sale, if not condemnation proceedings will be resorted to.

It does not appear that this district can be supplied with water by gravity at reasonable cost. The only alternative source which has been studied is the so-called Gaylord spring north of the railroad. This spring is of small capacity and is so situated that the danger of contamination of its waters is very great. There are various other springs and streams in the neighborhood which might be used, but it appears that the Cleveland spring is the most suitable for the present needs of the district. Water could be obtained by pumping from Lake Ontario, but this would have to be filtered and probably would be more expensive than the proposed supply.

It does not appear that the taking of the water of the Cleveland spring by this water district will in any way affect the present or future needs of any other civil subdivision of the State.

The legal damages which may be caused by the execution of the plans of the petitioner do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

In consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and the watershed from contamination and that filtration is at the present time unnecessary.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

Therefore, upon the above grounds, the application of the Sodus Water District is hereby approved and permission to acquire the above land and to construct and operate the above works is granted, subject to further inspection by this Commission as provided by section 523 of the Conservation Law.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto and has filed the same with all maps, plans, reports and other papers relating thereto in its office in the city of Albany, this 10th day of September, 1912.

CONSERVATION COMMISSION,
GEORGE E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 123.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter
of the
Application of the Board of Trustees of the VILLAGE OF LASALLE, for permission to purchase the plant and appurtenances of the LaSalle Waterworks Company and to make such extensions and alterations in connection therewith as may be necessary to secure a suitable and potable water supply for the said village of LaSalle, county of Niagara and State of New York.

Decision.

Application filed July 9, 1912.
Hearing held July 23, 1912.
Decision July 31, 1912.
Approved.

The village of LaSalle, by its Board of Trustees, on July 3, 1912, made application to the Conservation Commission for its approval of the proposed

purchase by the village of LaSalle of the plant and appurtenances of the LaSalle Waterworks Company and the making of such extensions and alterations in connection therewith as may be necessary, and of the obtaining of a supply of potable water for the village from either the city of Niagara Falls or the Western New York Waterworks Company. This application was filed July 9, 1912. On July 19, 1912, the Commission caused the site of the proposed works and the proposed sources of water supply to be inspected by one of its engineers.

After due notice, published in the *Union Sun* of Lockport and the *Journal* of Niagara Falls, a hearing was held on this petition in the village hall of LaSalle on July 23d at 10:30 A. M. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. The petitioner was represented by George M. Tuttle, Attorney, and no one appeared in opposition to the project.

After due study of the petition and its exhibits, the evidence and the arguments given at the hearing, it appears as follows:

LaSalle is a village in Niagara county, incorporated December 2, 1897, under the General Village Law. It lies on the right bank of the Niagara river, immediately east of the city of Niagara Falls, the village and city having a common boundary at this point. The population at the time of the last census was 1299; it is estimated at present at 1,500. There is no bonded indebtedness and at the time of the last roll the assessed valuation was $1,729,000.

LaSalle, until very recently, was supplied with water by the LaSalle Waterworks Company. The plant of this company was taken over by the village in May 19, 1912, and is still used to supply water to it. The plant of the LaSalle Waterworks Company was installed many years ago at a cost of approximately $43,000. The source of supply is Little river, a branch of the Niagara river, running behind Cayuga island. Water is pumped by a motor driven plunger pump to a standpipe of 50,000 gallons capacity and from thence runs by gravity and without purification through various pipes and mains to different parts of the village. Twenty-eight fire hydrants are provided and the effective pressure upon them is about thirty-three pounds. The water pumped is grossly contaminated by sewage from Buffalo and the Tonawandas and without filtration is entirely unsuited for domestic consumption. The pumping plant is antiquated and in poor condition and the capacity of the standpipe somewhat small for efficient fire protection. The pressure is low, but can be increased by speeding up the pump. The present consumption of the village is estimated at approximately 200,000 gallons per day.

On March 19, 1912, the electors of the village voted to purchase the present plant for a sum not to exceed $30,000, to raise, by the issue of bonds, an amount not to exceed $20,000 for the construction of additional water supply works and to appoint a Board of Water Commissioners. The Water Commissioners were duly appointed and they proceeded to take over the works of the old company. These works are now operated by the village, although they have not been paid for. Mr. Archibald P. Smith was appointed engineer and prepared plans, reports and estimates on the project of supply-

ing the village with water from one of the two water supply systems in the city of Niagara Falls. These plans, reports and estimates were submitted with the application. The Board of Water Commissioners then requested the Board of Trustees to issue bonds to the amount of $42,500, of which sum $12,500 was to be used in making extensions and changes in the mains; the remainder for the purchase of the existing plant.

The municipal water supply plant at Niagara Falls obtains water by pumping from the Niagara river to a point about 500 feet west of the eastern boundary of the city. The intake and crib are situated 2,200 feet from the shore. Water flows by gravity from the river to a basin near the pumping station, from which it is pumped by low lift pumps, having a capacity of 15,000,000 gallons per day, intó the filters. These are rapid sand filters of Continental type, having a total rated capacity of 16,000,000 gallons per day. Before going to the filters, alum is applied to the water as a coagulant. From the clear water basin of the filtration plant the water is pumped by high lift pumps into the mains laid in the streets of the city of Niagara Falls. There are three of these pumps, each having a capacity of 7,000,000 gallons, pumping against a normal pressure of seventy-five pounds per square inch. The pumps are all motor driven centrifugal units run by power from the large power stations on both sides of the falls. The present rate of pumping runs from 13,000,000 to 17,000,000 gallons per day and has occasionally been as high as 18,000,000 to 19,000,000 gallons. The pressures have occasionally been as high as 90 to 100 pounds per square inch. The mains are still being extended and more connections being made daily, which will increase the demand, unless the present waste is cut down. The population supplied at present is 22,000 persons, showing that the per capita consumption is apparently abnormally high. There is no standpipe in connection with the municipal plant. No definite offer has been made by the city to the village and it is not known at what price, or at what pressures they would undertake to supply water.

The Western New York Waterworks Company was installed to supply the village of Niagara Falls many years ago and has supplied that village, now included in the city of Niagara Falls, up to the last year, when the municipal plant was put in operation and a large number of the connections formerly made to the mains of the private company taken over. The pumping plant of this company is adjacent to the power house of the Niagara Falls Power Company and water is taken from the power canal. Low lift pumps, having 16,000,000 gallons per day capacity, raise the water from the canal into a sedimentation tank of 500,000 gallons capacity, alum being applied as a coagulant. From this tank the water flows by gravity through rapid sand filters of the Cincinnati pattern, having a capacity of 11,000,000 to 16,000,000 gallons per day. A wash water tank is provided with a capacity of 120,000 gallons and a maximum head on the filters of forty feet. At present the high lift pumps are installed in the wheel pit of the Niagara Falls Power Company. These are two plunger pumps driven by pelton wheels, each having a capacity of 6,000,000 gallons per day. This pumping plant is about to be replaced by three motor driven centrifugal pumps, each of 4,000,000 gallons per day capacity, which are to be installed in the same

house with the filters. These pumps will be run against a pressure of seventy-three pounds per square inch. A standpipe of 750,000 gallons capacity is located in the higher portion of the city, the standpipe being eighty feet high and so arranged that the pressure in the mains can exceed the standpipe pressure if required. The private company is now pumping about 7,000,000 gallons per day and estimates that there is a leakage of 2,500,000 gallons per day, which they expect to be able to stop. The plant can readily supply 11,000,000 gallons per day. The company has offered to furnish between 200,000 and 500,000 gallons of water per day to the village of LaSalle at the village line, with a pressure of not less than fifty pounds on the far side of the meter, at $20, net, per million gallons. The pressure will almost always be greater than fifty pounds; they guarantee that it will not be less.

The two filter plants now operating in the city of Niagara Falls seem to be efficient, and, as long as the rate of filtration is not increased beyond the proper capacity of the filters, either one will be able to supply water suitable for domestic consumption.

The village of LaSalle proposes to extend a 10-inch main to the village line and there to connnect with one or the other of the two systems in the city. In addition, the distribution pipes in the village streets will be extended, largely for the purpose of connecting up dead ends, and the number of fire hydrants will be increased from 28 to 50. In case there is any deficiency of pressure, it is proposed to install a motor driven centrifugal pump, which will take water from the existing standpipe and force it under higher pressure into the mains; this to be done only in case of fire. There are no buildings in the village over two stories in height, so that the required pressure for fire purposes is not high.

The estimate of the cost of the proposed works, submitted by the village engineer, appears to be reasonable and it ought to be possible to construct these works within the appropriation provided for the purpose.

The works, if properly constructed of suitable materials, will be safe.

It is not proposed to acquire any land other than that now owned by the LaSalle Waterworks Company.

In addition to the two alternative sources contemplated by the village authorities, it does not appear that the village could be supplied, except by rebuilding the present pumping plant and installing efficient filters, so that they could pump their own water from the Niagara river, or, if the proposed project for supplying the towns along the Falls Branch of the New York Central and Hudson River Railroad with water from the Linden reservoir should be put through, the village could be supplied from this system.

It does not appear that the execution of the proposed plans of the village of LaSalle will injuriously affect any civil subdivision of the State, provided that the system from which water is purchased has sufficient water to spare over and above the needs of its consumers in the city of Niagara Falls.

The legal damages which may be caused by the execution of the plans of the petitioner do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

In consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That the said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and the watershed from contamination and for the proper filtration of such supply.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

Therefore, upon the above grounds, the application of the Board of Trustees of the village of LaSalle is hereby approved and permission to construct and operate the above works is granted, subject to further inspection by this Commission as provided by section 523 of the Conservation Law.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto and has filed [L. S.] the same with all maps, plans, reports and other papers relating thereto in its office in the city of Albany this 31st day of July, 1912.

CONSERVATION COMMISSION.
GEORGE E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 124.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of the CITY OF CORTLAND by and through the Cortland water board, for permission to acquire additional lands for the prevention of the contamination of the water supply and for the approval of its maps and profiles, as amended.	*Decision.*

Application filed June 22, 1912.
Decision July 31, 1912.
Approved.

This is an application by the city of Cortland to obtain the consent of the Conservation Commission to the proposed purchase of certain land desired for the purpose of protection of the water supply of the city. This land is designated on the map which accompanied the petition as Parcel No. 10, having an extent of 4.38 acres.

On June 17, 1911, the city of Cortland filed an application with the State Water Supply Commission for permission to acquire title to nine parcels of real property, containing 63.966 acres, for the purpose of preventing the pollution of the water supply. This previous application (Water Supply Application No. 98) and the papers attached thereto and the proceedings in connection therewith are made a part of this present application. After holding a hearing, at which no objections were filed, the State Water Supply Commission granted the former application on July 11, 1911, finding that:

> "Upon several of these parcels are positive and openly apparent causes of pollution and upon others are possible sources of pollution, especially if the water plant should be required to furnish any addition to its present output."

and the Water Supply Commissioners further stated that:

> "We have repeatedly held in similar applications to this that it was the duty of those charged with furnishing a pure and wholesome supply of water to eliminate every possible source of contamination and plans for this purpose have always had approval."

Upon examination of the map submitted, it appears that said Parcel No. 10 is immediately adjacent to and of a character similar to the nine parcels originally purchased and there seems good reason to believe that the findings of the Water Supply Commission in regard to the other parcels also apply to this parcel.

It further appears that the city expects to be able to buy this land at private sale and that it is financially able to make this purchase.

No waterworks construction is contemplated.

The Commission deemed it unnecessary to hold a hearing on this application.

In consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and the watershed from contamination and that filtration is at present unnecessary.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

Therefore, upon the above grounds, the application of the city of Cortland is granted.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto and has filed [L. S.] the same with all maps, plans, reports and other papers relating thereto in its office in the city of Albany this 31st day of July, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 125

Village of Brockport, Monroe County, N. Y.

Application filed August 23, 1912.

Hearing held September 27, 1912.

The village of Brockport applied for approval of the installation of a municipally owned and operated water supply system for the village. It is proposed to obtain water from Lake Ontario, filter it through a slow sand filter and pump it to the village.

The Brockport–Holley Water Company is now operating in this village, water for its system being obtained from wells near the village of Holley.

A hearing was had upon this application September 27th and was adjourned to October 10, 1912.

WATER SUPPLY APPLICATION NO. 126.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of WATER DISTRICT No. 1 OF THE TOWN OF LOCKE, Cayuga county, N. Y., to acquire a water supply, etc.	*Decision.*

Application filed August 29, 1912.
Hearing held at Locke, September 11, 1912.
Decision September 24, 1912.
Approved.

Water District No. 1 of the town of Locke, by its Board of Water Commissioners, on August 29, 1912, filed with the Conservation Commission an application for the approval by that Commission of the proposed acquisition of a source of water supply by the water district and of the plans of the proposed waterworks construction. On August 30, 1912, the Commission caused the site of the proposed works to be inspected by one of its engineers.

After due notice, published in the Locke *Courier* and the Auburn *Citizen*, a hearing was held on this application in the town clerk's office in the village of Locke on the 11th day of September, 1912, at 10 o'clock in the forenoon. At this hearing the Commission considered the petition, maps and plans submitted, examined witnesses and heard arguments for the project, as shown by the minutes. The petitioner was represented by Wright & Parker, its attorneys, and by the Water Commissioners in person. No objections to the granting of this petition were filed and no one appeared in opposition at the hearing.

After due study of the petition and its exihibts, the evidence and arguments given at the hearing and the report of its engineer, it appears as follows:

Water District No. 1 of the town of Locke covers the unincorporated village of Locke, which is situated on Owasco inlet and the Auburn branch of the Lehigh Valley Railroad near the southern boundary of Cayuga county. The district was formed August 5, 1912, by order of the Town Board of Locke acting upon a petition signed by all the taxpayers resident within the district, with one exception. It is estimated that the district has a population of approximately 400 persons, an assessed valuation of $120,000 and no outstanding indebtedness, except for certain bonds issued by the school district, which includes, but is considerably larger than, the water district.

The village of Locke at the present time is entirely without a public water supply, water for domestic purposes being obtained from deep wells. Recently a fire devastated the central portion of the village, burning between thirty and forty buildings, including the hotel and church. This district is now being rebuilt and, in order to prevent a recurrence of the disaster,

the inhabitants of the village desire to install a waterworks system in order to obtain fire protection.

The plans submitted to the Town Board with the taxpayers' petition were prepared by the firm of Morrison and Farrington, Inc., engineers, the work being directly in charge of Mr. Charles A. Bowman. Upon the formation of the water district, these engineers were retained by the Water Commissioners, and will have charge of the construction of the work, if it is carried out.

It is proposed to obtain water from Hotchkiss creek, a stream which flows south and east into Owasco inlet, just north of the village. This stream drains a deep valley covered by sparsely settled farms, the lower portion being in a rocky gorge. The proposed point of diversion of the water is in this gorge, 2,800 feet from the village boundary, the watershed above which point is probably about one and one-half square miles. The flow at this point on July 23, 1912, was 93,000 gallons per day, the weather at that time being dry and the stream lower than usual.

Chemical and bacteriological analyses of the water of Hotchkiss creek were made by William M. Booth of Syracuse and submitted with the application. These show the water to be slightly hard, but otherwise suitable for domestic consumption. There are a few barns near the stream which might possibly cause contamination. One of these is to be moved bodily and the others will be watched and kept in a sanitary condition.

It is proposed to build a masonry dam about ten feet high in the gorge of Hotchkiss creek, forming a reservoir of approximately 150,000 gallons capacity, with a flow line at an elevation 192 feet above the intersection of Main and Cayuga streets in the district. From this dam water is to be carried through a 6-inch supply conduit to the district, where it will flow through distribution mains six inches and four inches in diameter, laid in the streets in the usual manner. A considerable length of this supply conduit is laid in a gorge which has solid rock sides and it will be impossible to cover this portion of the line. In order to prevent freezing, it will be necessary to keep a constant flow in this pipe during cold weather and for that purpose a 4-inch blow-off pipe is to be installed within the limits of the district, discharging into Owasco inlet. Thirteen fire hydrants are to be installed at intervals of not over 500 feet along any street, and the spacing of these hydrants, diameters of the pipes and available pressures are sufficient to give adequate fire protection.

The amount available for the construction of these works is $9,000, which it is proposed to raise by a bond issue. It appears that this amount will be sufficient to pay for the acquisition of the necessary land and the construction of the works proposed.

The works, if carefully constructed, in accordance with the approved plans, of good materials and with careful workmanship, will be safe. Land will be purchased for the construction of the reservoir and for right of way of the main conduit to the village. It is expected that all this land can be acquired by private sale.

An examination of the United States Geological Survey map shows several possible alternative sources of supply, but of these Hotchkiss creek appears to be the most favorable source. Whipple creek, which runs east and north of

and parallel to Hotchkiss creek, can give an additional supply of possibly a slightly greater yield.

The springs above the dam, water rights and some of the land are now owned by the village of Moravia, having been purchased some years ago by the water company which supplied that village before the village authorities purchased the waterworks. The village of Moravia is willing to sell these springs to the water district and does not regard them as necessary for their own use.

It does not appear that the water supply of any other civil division of the State will be affected by the execution of the proposed plans.

The legal damages which may be caused by the execution of the plans of the petitioner do not appear to be such as to require any special consideration or legislative enactment in order that they may be equitably determined and paid.

In consideration of the above, the Commission therefore finds and determines:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and the watershed from contamination and that filtration is at the present time unnecessary.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

Therefore, upon the above grounds, the application of Water District No. 1 of the town of Locke is hereby approved and permission to acquire the above land and to construct and operate the above works is granted, subject to further inspection by this Commission as provided by section 523 of the Conservation Law.

[L. S.] IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto and has filed the the same with all maps, plans, reports and other papers relating thereto in its office in the city of Albany this 24th day of September, 1912.

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 126.

STATE OF NEW YORK — CONSERVATION COMMISSION.

In the Matter of the Application of WATER DISTRICT NO. 1 OF THE TOWN OF LOCKE, Cayuga County, N. Y., to acquire a water supply, etc.	*Supplemental decision.*

Supplemental application filed October 24, 1912.

Supplemental decision November 8, 1912.

Approved.

Water district No. 1 of the Town of Locke, by its board of water commissioners, on October 24, 1912, filed with the Conservation Commission a supplemental petition asking that the approval of the Conservation Commission, given September 24, 1912, on the application of the water district filed with the Conservation Commission August 27, 1912, be modified to cover an increase in the amount authorized to be expended by the water district from $9,000 to $10,500.

An examination of the papers attached to this supplemental petition shows as follows:

Water District No. 1 of the Town of Locke was formed under the provisions of section 282 of the Town Law, by order of the town board of Locke, Cayuga county, N. Y., on August 5, 1912, this action being taken upon a petition duly signed by a majority of the owners of taxable property within the proposed water district, which was filed with the town board July 26, 1912. This order of the town board appointed three water commissioners for the district and these commissioners have duly qualified and entered into the performance of their duties. On August 26, 1912, the water district petitioned the Conservation Commission for its approval of the proposed acquisition of a source of water supply and of the plans for a water supply system. This petition was filed in the office of the Conservation Commission August 27, 1912, and, after due notice, a hearing was had upon this petition in the village of Locke on September 11, 1912, and upon September 24, 1912, the Conservation Commission approved of the said application of Water District No. 1 of the Town of Locke, having found and determined:

First. That the plans proposed are justified by public necessity.

Second. That said plans provide for the proper and safe construction of all work connected therewith.

Third. That said plans provide for the proper protection of the supply and the watershed from contamination and that filtration is at the present time unnecessary.

Fourth. That said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth. That said plans make fair and equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands.

It now appears that when the bids for the construction of the proposed waterworks system were opened publicly and canvassed on September 25, 1912, it was found that the lowest bid exceeded the sum of $9,000, which was the amount authorized to be expended by the water district. Thereupon a majority of the owners of taxable property in the water district signed a supplemental petition, which was filed in the office of the town clerk of Locke, Cayuga county, on October 1, 1912, and, after due notice, the town board on October 14, 1912, acting upon this petition, authorized the district to raise a sum not exceeding $10,500. The water district on October 19, 1912, petitioned the Conservation Commission to modify its decision of September 24, 1912, in such a manner as to approve of the larger expenditure, amounting in all to not over $10,500. This supplemental petition was filed in the office of the Conservation Commission on October 24, 1912. No change is contemplated in the plans or in the works to be constructed, and there appears to be no reason why the district cannot afford to expend the increased amount upon its water supply system.

Therefore, the Conservation Commission finds and determines that the previous determinations made by it in its decision of September 24, 1912, upon the application of Water District No. 1 of the Town of Locke, filed August 27, 1912, also hold for the original petition of the water district as modified by the supplemental petition filed October 24, 1912.

Therefore, upon the above grounds, both the original and supplemental petition of Water District No. 1 of the Town of Locke are hereby approved, and permission to acquire land and to construct and operate the works is granted, subject to further inspection by this Commission as provided by section 523 of the Conservation Law.

IN WITNESS WHEREOF, the Conservation Commission has caused this determination and approval to be signed by the Commission and has caused its official seal to be affixed hereto and has filed the same with all maps, plans, reports and other papers relating thereto in its office in the city of Albany this 8th day of November, 1912.

[L. S.]

CONSERVATION COMMISSION.
GEO. E. VAN KENNEN,
JAMES W. FLEMING,
JOHN D. MOORE,
Commissioners.

ALBERT E. HOYT,
Secretary to Commission.

WATER SUPPLY APPLICATION NO. 127.

Madrid Water District, St. Lawrence county.

Application filed August 31, 1912.

Hearing held September 25, 1912.

The petition asked for approval of the plan of installing a water supply system for the unincorporated villages of Madrid and Madrid Springs, water to be pumped from the Grasse river within the limits of the village of Madrid.

This application is still being investigated and no decision has yet been made.

WATER SUPPLY APPLICATION NO. 128.

Albion Water Works Company of Albion, Orleans county, N. Y.

Application filed September 11, 1912.

The petition asked for the approval of the taking of an additional source of water supply from Otter creek near Eagle Harbor, the taking of this water necessitating the construction of a larger impounding reservoir upon the creek, a new pumping station, slow sand filter plant and certain additions and changes to the existing works.

The Albion Water Works Company has been operating in the village of Albion for many years. Heretofore it has obtained water from driven wells within the village limits, from Otter creek at Eagle Harbor and, at times, from the Erie canal.

The Commission has not yet taken action upon this application.

WATER SUPPLY APPLICATION NO. 129.

Town of Scarsdale — North End Water District.

Application filed September 16, 1912.

Petition asked for approval of the installation of a water supply system within a portion of the town of Scarsdale, water to be purchased from the Consolidated Water Company of Suburban, N. Y., which company pumps its water from the Pocantico river.

The Commission has not yet taken action upon this application.

WATER SUPPLY APPLICATION NO. 130.

New Castle Water Company, Chappaqua, Westchester county, N. Y.

Application filed September 23, 1912.

Petition asked for the approval of the construction of a dam to augment the water supply of the districts supplied by this company.

The application is not yet complete and no action has been taken upon it by the Commission.

APPENDIX E

Action Taken On Sewerage Applications Up To September 30, 1912.

SEWERAGE APPLICATIONS.

The following is a list of all sewerage applications which have been acted upon by the Conservation Commission up to the present time. The disposition of each case is shown.

No.	Applicant	Approved State Dep't of Health	Action by Commission	
1.	Matteawan	Aug. 22, 1911.	Approved	Sept. 15, 1911.
2.	Rome	Sept. 16, 1911.	Approved	Nov. 29, 1911.
3.	Bronxville — Kraft Ave.	Oct. 16, 1911.	Not submitted.	
4.	Troy — Belle Ave.	Oct. 17, 1911.	Approved	Jan. 2, 1912.
5.	Troy — Parkway Villa	Oct 17, 1911.	Approved	Dec. 29, 1911.
6.	Troy — Albia St.	Sept. 10, 1911.	Approved	Nov. 29, 1911.
7.	Troy — Francis Ave.	Nov. 10, 1911.	Approved	Nov. 27, 1911.
8.	Whitney, C. L. A.	Nov. 10, 1911.	Approved	Dec. 29, 1911.
9.	Oswego	Nov. 10, 1911.	No action.	
10.	Newark	Dec. 6, 1911. Apr. 2, 1912.	Approved Approved	Dec. 21, 1911. Apr. 23, 1912.
11.	Rockville Center	Dec. 19, 1911.	Approved	Feb. 9, 1912.
12.	Binghamton — Perry & Frank Sts.	Nov. 1, 1911.	Approved	Jan. 18, 1912.
13.	Binghamton — Florence Ave.	Nov. 28, 1911.	Approved	Jan. 18, 1912.
14.	Ithaca — Dryden Road and Maple Place	Nov. 2, 1911.	Approved	Jan. 18, 1912.
15.	Borden's Condensed Milk Co., Granville	Nov. 16, 1911.	Discontinued.	
16.	Schenectady	Jan. 17, 1912.	Approved	Feb. 15, 1912.
17.	Gilbert, F., Jr., & Co., Butternuts	Oct. 24, 1911.	Approved	Jan. 18, 1912.
18.	Brigham Creamery, Collins	Nov. 28, 1911.	Approved	Jan. 18, 1912.
19.	Granger & Horton, Binghamton	Oct. 23, 1911.	Approved	Jan. 18, 1912.
20.	Albion	Nov. 28, 1911.	Approved	Feb. 8, 1912.
21.	Binghamton and Lestershire	Jan. 18, 1912.	Approved	Feb. 13, 1912.
22.	Middleport	Jan. 18, 1912.	Approved	Mar. 21, 1912.
23.	Hobart	Nov. 28, 1911.	Approved	Feb. 7, 1912.
24.	Hudson	Feb. 1, 1912.	Discontinued.	
25.	Binghamton — Yager, Ogden, Seminary Ave.	Feb. 26, 1912.	Approved	Mar. 28, 1912.
26.	Watertown — Highland Ave., Brett and Anne Sts.	Feb. 26, 1912.	Approved	Mar. 28, 1912.
27.	Port Chester	Feb. 26, 1912.	Approved	May 21, 1912.
28.	Cattaraugus Tanning Co., Olean	Feb. 20, 1912.	Approved	Apr. 23, 1912.

No.	Applicant	Approved State Dep't of Health	Action by Commission	
29.	Avon	Mar. 4, 1912.	Approved	Apr. 16, 1912.
30.	Springville	Mar. 4, 1912.	Approved	May 1, 1912.
31.	Palatine Bridge	Mar. 13, 1912.	Approved	Apr. 16, 1912.
32.	Binghamton — Fairview Ave.	Mar. 21, 1912.	Approved	Apr. 28, 1912.
33.	New Hartford	Apr. 12, 1912.	Approved	May 21, 1912.
34.	Auburn	Apr. 17, 1912.	Approved	May 21, 1912.
35.	Watertown — North Side Sanitary Sewer	Apr. 17, 1912.	Approved	May 6, 1912.
36.	Weaver, S. J., Deerfield	Apr. 17, 1912.	Approved	May 6, 1912.
37.	Troy — Tenth St.	Apr. 23, 1912.	Approved	May 6, 1912.
38.	Fire Island Park, Islip	Apr. 23, 1912.	Approved	May 21, 1912.
39.	Scudder, M. L., Huntington	Aug. 14, 1912.	Approved	Aug. 28, 1912.
40.	Binghamton — Chapin St.	Apr. 29, 1912.	Approved	May 6, 1912.
41.	Frankfort	May 2, 1912.	Approved	June 4, 1912.
42.	Watertown — Lillian Ave.	May 6, 1912.	Approved	July 5, 1912.
43.	Glen Cove Sewer District	May 8, 1912.	Approved	May 21, 1912.
44.	Western House of Refuge for Women, Albion	May 8, 1912.	Approved	May 21, 1912.
45.	Brooks, Mrs. I. E., Whitney's Point	May 15, 1912.	Approved	July 31, 1912.
46.	Blythdale Home, Mt. Pleasant	May 15, 1912.	Approved	June 4, 1912.
47.	Fairview Country Club, Mt. Pleasant	May 15, 1912.	Approved	June 4, 1912.
48.	Johnstown—Thyneville Trunk Sewer	May 15, 1912.	Approved	June 13, 1912.
49.	Ogdensburg—Main and Ford Sts.	May 28, 1912.	Approved	June 4, 1912.
50.	Binghamton—Starr Ave. and Phelps St.	May 28, 1912.	Approved	June 13, 1912.
51.	Johnstown — Prospect St.	May 28, 1912.	Approved	July 5, 1912.
52.	Willard State Hospital	June 13, 1912.	Approved	July 5, 1912.
53.	Y. M. C. A., New York City, 23d St.	June 6, 1912.	Approved	Aug. 12, 1912.
54.	Mamaroneck — Boston Post Road	June 6, 1912.	Approved	July 5, 1912.
55.	Watertown — Tilden St.	June 6, 1912.	Approved	July 5, 1912.
56.	Wm. T. Edwards	June 12, 1912.	Approved	July 5, 1912.
57.	Binghamton — Hanchett Ave.	June 13, 1912.	Approved	July 5, 1912.
58.	Waccabuc Inn Co.	June 13, 1912.	Approved	July 5, 1912.
59.	F. W. Janssen	June 18, 1912.	Pending.	
60.	Dwight Ballard	June 18, 1912.	Pending.	
61.	Fulton County Tuberculosis Hospital	June 19, 1912.	Approved	Aug. 13, 1912.
62.	Watervliet — Third St., Second Ave.	June 20, 1912.	Approved	July 22, 1912.
63.	King's Park State Hospital	June 28, 1912.	Approved	July 5, 1912.
64.	Saranac Lake — Flower and Lake Avenues	June 20, 1912.	Approved	Aug. 12, 1912.

No.	Applicant	Approved State Dep't of Health	Action by Commission	
65.	Cheektowaga	June 22, 1912.	Approved	July 31, 1912.
66.	Ilion	June 25, 1912.	Approved	Aug. 12, 1912.
67.	Cedarville Milk & Creamery Co.	June 28, 1912.	Approved	Aug. 28, 1912.
68.	Binghamton — Gaylord St. & Riverside Drive	June 29, 1912.	Approved	July 5, 1912.
69.	Watertown — Massey St....	June 29, 1912.	Approved	July 5, 1912.
70.	Oakwood Seminary, Union Springs	June 29, 1912.	Approved	Aug. 12, 1912.
71.	Ithaca — York and Falls Sts.	July 13, 1912.	Approved	Aug. 12, 1912.
72.	Litchfield, Edward H.......	July 17, 1912.	Approved	Aug. 12, 1912.
73.	Franklinville—Washburn and other streets	July 13, 1912.	Approved	Aug. 15, 1912.
74.	Binghamton — Elm and West Sts.	July 17, 1912.	Approved	Aug. 12, 1912.
75.	Poughkeepsie—Columbia and Albany Sts.	July 17, 1912.	Pending.	
76.	Town of Triangle — School District No. 10...........	July 17, 1912.	Approved	Aug. 13, 1912.
77.	Essex Co-operative Creamery Co., Boquet, Essex Co.....	July 22, 1912.	Approved	Aug. 28, 1912.
78.	Williams, F B., Norwich...	July 24, 1912.	Approved	Aug. 12, 1912.
79.	Mt. Kisco	July 25, 1912.	Approved	Sept 26, 1912.
80.	Goodrich, S. H.............	July 29, 1912.	Approved	Aug. 29, 1912.
81.	Watervliet — Third Ave. and Eighth St.	July 31, 1912.	Approved	Aug. 13, 1912.
82.	Quinn, M. J., Eveleigh House, Sacketts Harbor	July 30, 1912.	Approved	Aug. 13, 1912.
83.	Hamilton College Sewer District, Kirkland, Oneida Co.	Aug. 7, 1912.	Approved	Aug. 13, 1912.
84.	Keuka College, Keuka Park.	Aug. 9, 1912.	Approved	Aug. 13, 1912.
85.	State Normal College, Oswego	Aug. 5, 1912.	Approved	Aug. 13, 1912.
86.	St. Joseph's Normal College, Pocantico Hills	Aug. 5, 1912.	Approved	Sept. 10, 1912.
87.	Borden's Condensed Milk Co., Richford	Aug. 6, 1912.	Approved	Aug. 28, 1912.
88.	Binghamton—Bevier and Willard Sts.	Aug. 8, 1912.	Approved	Sept. 6, 1912.
89.	Troy — Willis St. and Lincoln Ave.	Aug. 13, 1912.	Approved	Aug. 17, 1912.
90.	St. Joseph's Institute, Throgs Neck	Aug. 14, 1912.	Approved	Aug. 29, 1912.
91.	North Pelham — Pelhamwood District	Aug. 14, 1912.	Approved	Aug. 29, 1912.
92.	Binghamton — Silver and Grant Sts.	Aug. 24, 1912.	Approved	Aug. 29, 1912.

No.	Applicant	Approved State Dep't of Health	Action by Commission	
93.	Tuckahoe—Circuit and Pleasant Avenues	Aug. 24, 1912.	Pending.	
94.	Ogdensburg — Pickering and North Sts.	Aug. 24, 1912.	Approved	Aug. 29, 1912.
95.	Oneonta — Parish Ave......	Aug. 27, 1912.	Pending.	
96.	Victory Butter Co.........	Sept. 3, 1912.	Pending.	
97.	Ogdensburg—South Water St.	Sept. 9, 1912.	Approved	Sept. 16, 1912.
98.	Ballston Spa — Hides Ave. and Grove St............	Sept. 9, 1912.	Pending.	
99.	Long Beach Estates, Sterilization Plant..............	Sept. 9, 1912.	Pending.	
100.	State Reformatory for Boys, Napanoch.	Sept. 27, 1912.	Pending.	
101.	Herkimer — W. German, W. Steele and other streets...	Sept. 27, 1912.	Pending.	
102.	Konski, H. D., Residence....	Sept. 27, 1912.	Withdrawn.	
103.	Rose, Chas., Creamery, Jefferson	Sept. 27, 1912.	Pending.	
104.	Gilmore, J. H., Sheffield-Farms - Slawson - Decker Creamery, Jefferson	Sept. 27, 1912.	Pending.	

APPENDIX F

HYDROMETRIC REPORT.

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

WATER RESOURCES BRANCH

ALBANY, N. Y., *January* 31, 1913.

HON. GEO. E. VANKENNEN, *Chairman, State of New York Conservation Commission, Albany, N. Y.:*

DEAR SIR.— I have the honor to submit herewith a report on the co-operative hydrometric work carried on between the United States Geological Survey and the Conservation Commission, during the calendar year ended December 31, 1912.

I have been assisted in this work by Mr. O. W. Hartwell, Office Engineer, Mr. Geo. J. Lyon, Assistant Engineer, Mr. G. H. Canfield, Mr. C. S. DeGolyer, Mr. Frank Weber, Mr. J. G. Mathers, Junior Engineers, and Mr. W. A. James, Clerk, all of the United States Geological Survey force, Albany office.

Some of the work performed during the past year has been in the nature of pioneer work in stream gaging. Frequent conferences have been held with members of your Commission and the newer phases of the work thoroughly discussed before being put into operation. I wish to express my appreciation of the loyal support given by the Conservation Commission and to make special mention of the assistance rendered by Hon. John D. Moore, Commissioner of Inland Waters, by your Chief Engineer, Mr. R. W. Sherman, and his assistant engineers. Special acknowledgment is also due the Adirondack Power Company, International Paper Company, Union Bag & Paper Company and the Finch, Pruyn Paper Company, for financial co-operation in connection with the Hudson River station at Spier Falls; to the board of water commissioners, city of Auburn, for financial co-operation in connection with the Owasco Outlet station and to other power companies and individuals who have furnished gage readings and data herein contained.

Yours very truly,

C. C. COVERT,

District Engineer.

APPENDIX F

PROGRESS REPORT ON HYDROMETRIC WORK CARRIED ON IN CO-OPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY.

By C. C. COVERT, District Engineer, U. S. Geological Survey.

CONTENTS.

PROGRESS REPORT OF HYDROMETRIC WORK CARRIED ON IN CO-OPERATION WITH THE UNITED STATES GEOGICAL SURVEY.

Scope of Work.

It is the purpose of the hydrometric work of the Conservation Commission to furnish general information concerning the daily, monthly and yearly run-off of the various watersheds throughout the State, that the members of the Commission and other State officials as well as the general public may have adequate knowledge of the commercial value of the water resources of the State.

The problems connected with obtaining dependable stream flow data are greater in New York State and in New England than they are in almost any other part of the country. Most of the difficulties are caused by the following conditions:

First: In many cases the natural flow of the stream is disturbed by power operations or storage.

Second: During the winter months the formation of ice causes back water and changes the relation between gage height and discharge.

Third: Logging operations on certain streams often form jams which also affect the relation between gage height and discharge for varying periods.

On streams controlled by power and storage, the wide variations between morning and evening gage readings have led to the belief that these data do not fairly represent the mean gage height for a twenty-four hour period. Fluctuations in the daily stage are undoubtedly the chief contributing cause of the wide variations in the estimated monthly discharge at different stations on the same stream, especially where the data are obtained at current meter stations. To obtain the true mean daily gage heights at any station, a continuous twenty-four hour record is necessary, but it is practically impossible to obtain such a record with a staff or chain gage equipment.

Close examination of the data collected during the past decade leads to the conclusion that the methods in general practice were not suitable for all stations. It was found that under certain conditions, the data was not within the limits of accuracy required for the work contemplated by the Commission. Investigations showed that one of the main difficulties was diurnal fluctuation in gage height, and that instead of depending upon a local observer to obtain one or two readings each day, it would be necessary to install recording gages. On the more important streams thus affected we have constructed concrete wells and shelters and equipped the stations with automatic gages. Cables and stay wires have also been erected where necessary and the stations in general have been improved so that practically all records are within the limits of accuracy necessary for the work. That the improvements are beneficial is attested by the more consistent plotting of meter measurements and the more consistent relation between the records at different stations in the same drainage basins.

This intensive study of the flow of important rivers was begun in 1910 by the establishment of the Hadley and St. Helena automatic gaging stations. The favorable showing at the improved stations lead us to extend and to expand the work. An examination of the data from these stations accompanying this report, will readily convince any engineer or person familiar with stream flow data that the expenditure was justified.

Three recording gaging stations were established during 1912:

Hudson river at Spier Falls.

Owasco outlet near Auburn.

Raquette river at Piercefield.

Recording gages are not needed on every stream or even on every important stream. Flashy streams and those having their daily regimen of flow affected by artificial control for power or other purposes are the streams that usually require the recording gage. They may also be used to advantage on streams where the State proposes to construct storage reservoirs.

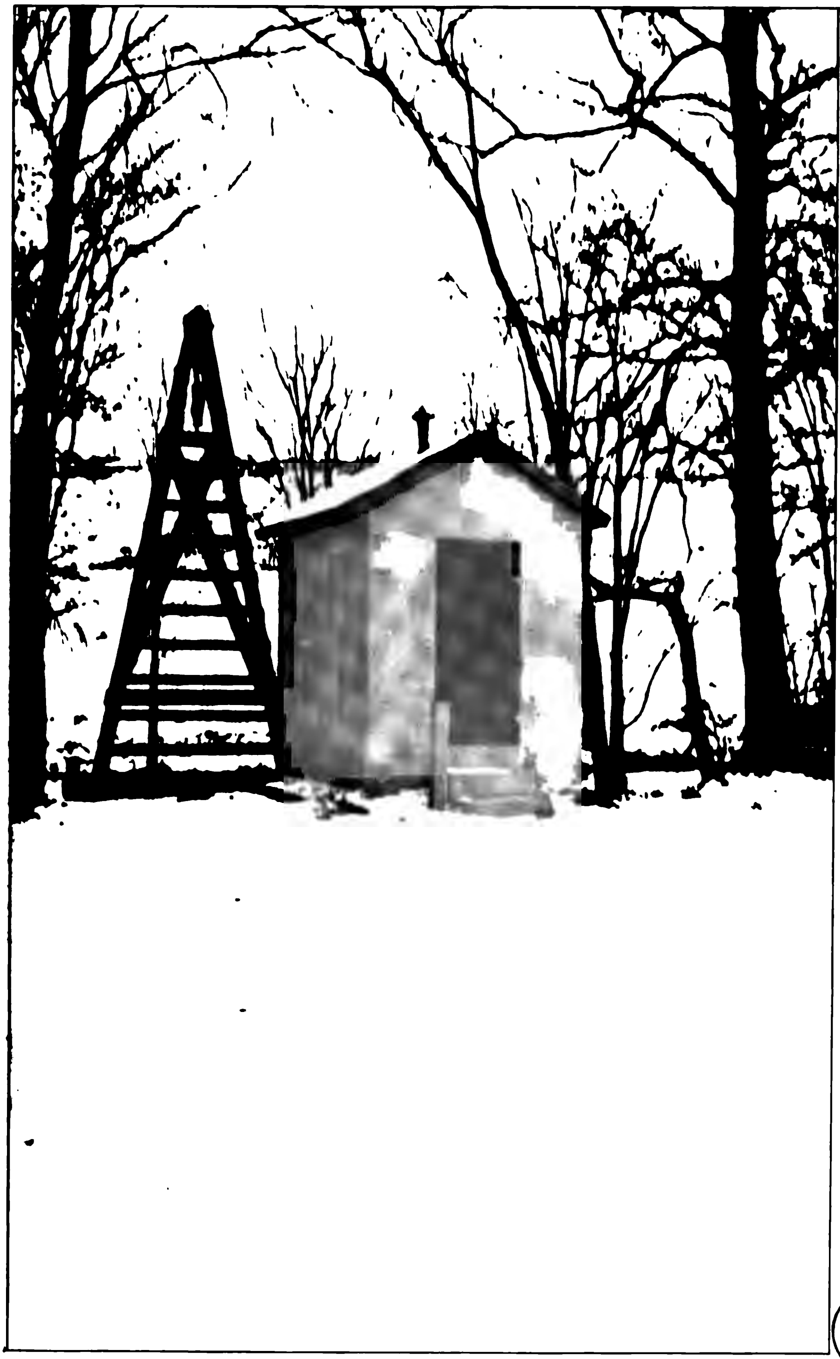
This departure from the regular procedure in stream gaging work, has led to some interesting problems in the way of housing the automatic gage. From the first our efforts were to make an installation that would give us continuous all-the-year-around records. We adopted a concrete well and placed it far enough back in the bank so that the water would be below the ground frost line. On top of this well we built a concrete shelter three feet square inside dimensions, and seven feet in height. (See Fig. A.) This shelter was found to be too small to allow of free access to the gage and to permit a man to work around it conveniently. The latest and most satisfactory shelter is five feet by six feet inside dimensions and about seven feet high. (See Fig. B.) The new plans also call for a well two feet six inches by six feet inside dimensions. This design admits of free handling of the gage for changing records or for adjustments. It will also permit of experimental work in connection with recording gages, that is, running two gages side by side, with a view to obtaining data on the general accuracy of each gage.

RECORDING GAGES.

There are a number of recording gages on the market, all having their good points and being fitted for the particular kind of work that the designer had in mind when perfecting his gage. The most common gage is that of the graph type with a horizontal cylinder driven by a band or chain, attached to a float which rides on the water surface and having a counter weight on its opposite end, while a clock moves a pen or pencil along the cylinder at a given rate of speed. Other gages have a vertical cylinder revolved by a clock while the float moves the pencil up and down along this cylinder. There are also the type of gage operating as a pressure gage and the gage that prints the time and the gage height to hundredths part of a foot at 15 minute intervals.

It will be necessary to experiment further with these different types of gages before we could recommend any one exclusively; it may also appear that different types will be needed under different conditions. This fact has been considered in the design of a standard shelter and well. Not only must the recording gage be viewed from the point of accuracy of record, but also

CONCRETE SHELTER AND RECORDING GAGE — SACANDAGA RIVER NEAR HADLEY. Fig. A.



CONCRETE SHELTER — OWASCO OUTLET NEAR AUBURN. Fig. B.

PORTABLE AUTOMATIC GAGE. Fig. C.

from the point of convenience in filing, and in translating its records. Most streams, where recording gages are placed, are of such a character that hourly gage heights are necessary to determine the daily discharge within a 5 per cent. limit. If the record sheet is such that expert engineers are required to deduce these hourly records, it will add considerably to the office expense of compiling the data for publication.

Makers of recording gages would do well to consider these points in perfecting their designs:

First: All cylinders of hydrograph gages should provide for an unlimited range of stage.

Second: The scale for time should be such that hourly readings can be obtained when necessary, and the scale for height should be such that readings can be readily and accurately made to hundredths of a foot.

Third: The design should also be such that the record need not be removed oftener than every three months, but may be removed daily if desired.

There are a few types of gages that will run for a year without removing the records and it is believed that these gages will prove the most valuable. There are conditions under which gages that require regular and frequent attention are very satisfactory. The former type of gage is, however, better adapted for general use.

At present we have six automatic gages obtaining continuous records of stream flow at as many different points within the State. These are as follows:

Genesee river at St. Helena.
Genesee river at Rochester.
Hudson river at Spier Falls.
Owasco outlet at Auburn.
Raquette river at Piercefield.
Sacandaga river at Hadley.

It will be seen that these stations are widely separated and cover nearly all of the important streams in New York.

The Genesee and Sacandaga are not under artificial control to any extent at present. However, if we take daily periods covering sudden floods on these streams, it can be shown that one or two readings a day may be subject to as much as 30 per cent. error. Just how much the records computed from one or two readings daily will tend to compensate, in a year's records, has not been determined. But even though, through a year, the records should compensate, they are not accurate enough for the problems arising on those streams, because we have entered upon an era of development in the use of water that places a different valuation upon this natural resource. If storage reservoirs are to be constructed, that will actually conserve, the records must have a degree of accuracy that will warrant the undertaking of developments well within the margin of variation shown by the present records.

The remainder of the streams on which automatic gages are located are so controlled by power operations that the automatic gages are absolutely necessary to obtain the true mean gage height for each day.

PROGRESS OF WORK.

During the past year the following new stations have been installed:

Deer river at Ironton.
East branch Oswegatchie at Newton Falls.
Hudson river at Spier Falls.
Indian river at Indian Lake.
Little Tonawanda creek at Linden.
Owasco outlet near Auburn.

During 1912 rating curves have been developed at eleven stations, as follows:

Ausable river at Ausable Forks.
Black river at Boonville.
Cattaraugus creek at Versailles.
Deer river at Ironton (low water section).
East branch Oswegatchie at Newton Falls (low and medium stages.)
Hudson river at Spier Falls (medium stage).
Little Tonawanda creek at Linden.
Owasco outlet near Auburn.
Sacandaga river at Hope.
West branch Sacandaga at Blackridge.
St. Regis river at Brasher Center.

In the report this year we are publishing the records for 32 stations, as against 20 in 1911, an increase of 55 per cent. Not only have the number of stations increased, but at several of the stations a continuous record is being maintained and we are able to publish within a very small margin of the true discharge, the maximum and minimum discharge for each day in the year. Of the 34 stations in operation during 1912 daily estimates are published for 32, or 94 per cent. of the total number of stations maintained. The remaining 6 per cent. will be rated during the coming spring.

RECOMMENDATIONS.

The establishing of base stations in each drainage basin is considered the important problem in future work. A few of these stations have been established but there is room for more and efforts should be made toward getting these records started. Base stations should be located near the center of the power zone of each basin and at places where they would not be destroyed by future development, and where the points of control would be permanent. These stations should be maintained indefinitely. Secondary stations could then be established at various points within the drainage where estimates of flow are desired. These secondary stations could be maintained for periods varying with the importance of such stations and could be amplified by comparison with the base station.

The base stations should have first consideration and be installed as soon as possible. The main value of the base station is in the length and continuity of its record and it is highly desirable that a base station be in operation in each drainage basin as soon as possible. It is recommended that a study be made with a portable recording gage (see fig. C) of the more important stations now in operation, to determine whether automatic gages are necessary at those stations.

The proper installation of a recording gage involves a large expenditure for one gaging station and it is advisable to obtain concrete evidence of the necessity of such a gage with temporary installation before putting in a permanent structure.

APPROPRIATIONS AVAILABLE FOR 1912–13.

The co-operative agreement between the United States Geological Survey and the State of New York Conservation Commission has been continued and the following funds are available for the stream gaging and rain fall studies for the fiscal year ending September 30, 1913:

State of New York Conservation Commission	$10,000
United States Geological Survey	1,000
Total	$11,000

GAGING STATIONS MAINTAINED IN 1912.

Hudson river at North Creek, September 21, 1907–1912.
Hudson river at Thurman, September 22, 1907–1912.
Hudson river at Corinth, June, 1904–1912.
Hudson river at Spier Falls, October 6 to December 31, 1912.
Hudson river at Mechanicville, December, 1888–1912.
Cedar river near Indian Lake, July 15, 1911, to December 31, 1912.
Indian lake reservoir at Indian Lake, July 22, 1900–1912.
Indian river near Indian Lake, July 1 to December 31, 1912.
Schroon river at Riverbank, September 23, 1907–1912.
Sacandaga river near Hope, September 15, 1911, to December 31, 1912.
Sacandaga river cable station near Hadley, November 12, 1910–1912.
West branch Sacandaga river at Blackbridge, March 14, 1911–1912.
Cattaraugus creek at Versailles, September 23, 1910–1912.
Little Tonawanda creek at Linden, July 10 to December 31, 1912.
Genesee river at St. Helena, August 14, 1908–1912.
Genesee river at Jones' Bridge near Mount Morris, May 22, 1903–1906, 1908–1912.
Genesee river at Elmwood avenue, Rochester, February 9, 1904–1912.
Canaseraga creek at Dansville, July 21, 1910–1912.
Keshequa creek at Sonyea, July 22, 1910–1912.
Owasco outlet near Auburn, November 17 to December 31, 1912.
Salmon river at Stillwater bridge near Redfield, June 24, 1911–1912.
Salmon river at Fox's bridge near Pulaski, September 5, 1900, to December 6, 1908, July 14, 1910–1912.
Orwell brook near Altmar, June 23, 1911, to December 31, 1912.
Black river near Boonville, February 16, 1911, to December 31, 1912.
Moose river at Moose River, June 5, 1900–1912.
Middle branch Moose river at Old Forge, November 8, 1911, to December 31, 1912.
Oswegatchie river near Ogdensburg, May 16, 1903–1912.
East branch Owsegatchie river at Newton Falls, October 6 to December 31, 1912.

Raquette river at Raquette Falls near Coreys, August 27, 1908, to November 10, 1912.

Raquette river at Piercefield, August 20, 1908–1912.

Raquette river at Massena Springs, September 21, 1903–1912.

Bog river near Tupper Lake, August 24, 1908, to June 30, 1912.

St. Regis river at Brasher Center, August 22, 1910–1912.

Deer river at Ironton, July 25 to December 31, 1912.

Ausable river at Ausable Forks, August 27, 1910–1912.

RAINFALL AND TEMPERATURE STATIONS MAINTAINED DURING THE YEAR 1912.

STATION.	County.	Drainage basin.	Observer.	Established.
*Altmar	Oswego	Salmon	Byron Helm	May 22, 1911
*Boonville	Oneida	Black	W. D. Charbonneau	Feb. 16, 1911
Faust	Franklin	Raquette	Santa Clara Lumber Company	Nov. 5, 1910
Forked Lake	Hamilton	Raquette	R. J. Dunning	†Sept. —, 1907
*Hooker	Lewis	Salmon	John Denning	May 19, 1911
*Horse Shoe	St. Lawrence	Raquette	W. R. Partridge	Nov. 4, 1910
Keepawa	Hamilton	Black	L. W. Brown	Sept. —, 1907
*Knowelhurst	Warren	Hudson	D. S. Austin	Nov. 2, 1910
*Leisher Mills	Lewis	Salmon	H. N. Schrader	May 18, 1911
*Linden	Genesee	Tonawanda creek	C. L. Schenck	Aug. 13, 1912
*Littlejohn Settlement	Oswego	Salmon	Mrs. Mich. Donahue	May 19, 1911
Morehouseville	Hamilton	Mohawk	Theo. C. Remonda	Sept. —, 1907
North Creek	Warren	Hudson	W. G. Kenwell	Sept. —, 1907
*North Osceola	Lewis	Salmon	Elmer A. Durst	May 17, 1911
*Northville	Fulton	Sacandaga	E. E. Parkes	Aug. 22, 1910
Old Forge	Herkimer	Black	Mrs. S. W. Nelson	Dec. 16, 1907
*Orangeville	Wyoming	Tonawanda creek	Mrs. Lizzie Putney	Aug. 13, 1912
*Otto Mills	Oswego	Salmon	Arza Clark	May 19, 1911
Potsdam	St. Lawrence	Raquette	A. E. Sutherland	‡Dec. 4, 1907
*Pulaski	Oswego	Salmon	Seymour J. Fox	May 15, 1911
*Redfield	Oswego	Salmon	W. G. Simmons	May 17, 1911
Rome	Oneida	Mohawk	John O'Mara	Nov. 1, 1910
*Smartville	Oswego	Salmon	F. O. DeLong	May 16, 1911
Stillwater	Oswego	Salmon	C. A. Hall	Nov. 15, 1911
*Varysburg	Wyoming	Tonawanda creek	E. K. Cooper	Aug. 13, 1912
*Wakely Dam	Hamilton	Hudson	Frank Pelon	Dec. 11, 1910
Wanakena	St. Lawrence	Oswegatchie	J. Otto Hamele	April 15, 1910
*Wards Creek	Franklin	Raquette	Mrs. Frank Eldred	Nov. 5, 1910
Wells	Hamilton	Sacandaga	Vernon E. Dewey	Dec. 21, 1910

*Rainfall station only.
† Records available September 1895 to date.
‡ Records available 1828–1848, 1889–1897, 1905, 1906.

ACCURACY AND RELIABILITY OF FIELD DATA.

Practically all discharge measurements made under fair conditions are within 5 per cent. of the true discharge at the time of observation. Generally speaking, the errors in meter measurements are largely compensating; therefore, the mean rating curve, when well defined, is considered much more accurate than the individual measurements.

At six of the stations maintained during 1912, gage heights are now being determined from Automatic Recording Gages. Gage heights so obtained are unquestionable.

At the remainder of the stations the work is, of course, largely dependent upon the reliability of the observers. With but few exceptions the observers perform their work honestly. The observations are made twice daily — Morning and evening. While these do not always give the mean height for the day, these errors also are compensating and can be considered as negligible for a period of one month, on uncontrolled streams, although a single day's reading may, when taken by itself, be considerably in error.

In order to indicate the probable accuracy of the computed results, footnotes are added and an accuracy column is inserted in the monthly discharge table. The accuracy column does not apply to the maximum or minimum, nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent.; B, within 10 per cent.; C, within 15 per cent.; D, within 25 per cent. Special conditions are covered by footnotes.

HUDSON RIVER DRAINAGE BASIN.

Description.

The principal sources of Hudson river lie in the wildest portion of the Adirondack mountains, in Essex county, northeastern New York. A number of branches, any one of which might possibly be considered the main stream, form its upper waters; but if the highest collected and permanent body of water be assumed as the true head, then the source of the Hudson becomes Lake Tear-of-the-Clouds, which lies at an elevation of 4,322 above tide, in the center of the triangle formed by Mount Marcy and Skylight and Gray Peaks.

The river flows rather irregularly southward until it reaches the northern boundary of Saratoga county, where it makes a sharp turn and flows eastward for about 12 miles, passing through the mountains and forming, as it cuts across the rocky strata, several falls of great height and beauty. At Hudson Falls, just below Glens Falls, it makes another abrupt turn and flows southward, continuing in this direction until it empties into New York bay.

From Lake Tear-of-the-Clouds to the mouth of the river the distance by water is probably about 300 miles. The total area drained is 13,366 square miles. The river is tidal to Troy, which is also at the head of navigation.

The headwater region is mountainous in character, is in general heavily wooded, and is dotted with numerous lakes and ponds. The rocks, belonging to the oldest formation and mainly granitic, are either bare or covered only with a layer of spruce duff, humus, and forest litter. The river emerges from the mountain region a few miles west of Glens Falls, and thence to Troy the topography is moderately rolling and the surface soil is chiefly sand. Below Troy the river follows the great depression which extends almost due north and south between New York bay and the St. Lawrence, flowing in an open valley bordered by well-cultivated lands, which rise with moderate slope from the stream. The Catskill Mountain region is reached 20 or 30 miles below Albany, and thence to the mouth of the river the im-

mediate valley is flanked by high hills, the Highlands of Orange county and the precipitous Palisades being especially noticeable.

The fall in the upper portion of the course is very rapid, amounting to about 64 feet per mile from Lake Tear-of-the-Clouds to the mouth of North creek, a distance of about 52 miles. From the mouth of North creek to the mouth of the Sacandaga the descent is nearly 14 feet per mile, distributed among rapids which diminish in frequency as the Sacandaga is approached. In the succeeding 26 miles to Fort Edward the river descends 418 feet more. One hundred and seventy-five feet is comprised within the three abrupt pitches at Palmer, Glens, and Bakers Falls, while most of the remainder occurs in the rapids between Jessup's Landing and the oxbow above Glens Falls. Between Glens Falls and Troy nearly the entire fall of the river is utilized for the development of water power.

The tributaries of the Hudson are numerous, and many of them are large and important. Indian river, Schroon river, and the Sacandaga unite with the main stream above Glens Falls, and between the latter point and Troy it receives Batten Kill, Fish creek, Hoosic river, and the Mohawk, the latter having several important tributaries, including West and East Canada and Schoharie creeks. The tributaries below Troy include Catskill, Esopus, and Rondout creeks, and Wallkill river from the west, and Kinderhook creek, Jansen Kill, Wappinger creek, Fishkill creek, and Croton river from the east.

The mean annual precipitation on the total basin of the Hudson is probably about 43 inches. It reaches a maximum of more than 55 inches in the heights of the Adirondacks, while in the eastern portion of the drainage area in southern Vermont, the mean annual total is only about 39 inches. Conditions during the winter period vary from the extreme cold and deep snow of the Adirondacks to the areas in the southern portion of the basin which are subject to frequent winter thaws.

The flow of the upper Hudson is controlled to some extent during the dry season by the use of Indian Lake storage reservoir, and the natural storage facilities in the Adirondack region are unsurpassed, there being a great many ponds and lakes, many of large size and fed from extensive drainage areas. Comprehensive plans for vast storage projects on the Sacandaga, Schroon, and upper Hudson are receiving the attention of the State of New York Conservation Commission. It is probable that on the various tributaries of the Hudson an increase in storage capacity of some 75 billion cubic feet is possible, and if this were developed the Hudson would be probably the most important water-power stream in the country. While a large amount of power has been developed in the Hudson drainage area there are vast quantities as yet unutilized, and the importance of this river basin is apparent, when it is considered that in proportion to its size it contains a greater population than any other important drainage basin in the United States with the single exception of that of the Delaware river.

The longest run-off record in the Hudson river drainage basin is that obtained at Mechanicville, which extends back to 1888.

COMPARISON OF DISCHARGE OF STREAMS IN THE HUDSON RIVER BASIN.

The following article was prepared by R. H. Bolster, Hydraulic Engineer, U. S. G. S., and published in water supply paper 301. It is of especial value

in sizing up records obtained at various points in the Hudson river drainage. The reader can get from it a clear idea of the value of the records obtained on Hudson river at Corinth for the years 1904–1912, inclusive, published in this report.

The statement made in this article about the records for the Sacandaga river at Hadley, refers to records at former stations on that stream and not to the cable station where records are now being obtained by an automatic gage. Comparisons for the year 1912 have been added to Mr. Bolster's article.

COMPARISON OF DISCHARGE OF STREAMS IN THE HUDSON RIVER BASIN.

The following records of discharge in the Hudson river drainage basin are published for the purpose of comparison and of analytical study and reference. The records for Hudson river published in Water-Supply Papers 241, 261, 281, and 301, which are assumed to be essentially correct, are used in the tables below, but certain sources of minor errors in the monthly mean discharge should be noted.

Hudson River at North Creek.— Same rating curve used 1907–1911.

Hudson River at Thurman.— Same rating curve used 1907–1911; all determinations of discharge exceeding about 8,000 second-feet, published 1907–1911, are about 1 to 5 per cent. too low.

Hudson River at Corinth.— Records used as published on pages 335–337.

Hudson River at Mechanicville.— No change in published record except that 190 second-feet has been added to discharge May to November on account of diversion to Lake Champlain canal.

Schroon River at Riverbank.— Correct rating curves used 1907–1911, except for discharge exceeding about 5,000 second-feet, for which the published figures are about 1 to 5 per cent. too low for 1907–1909.

Sacandaga River at Wells.— Revised determinations published in Water-Supply Paper 281 used.

Sacandaga River at Northville.— Same curve for high stages from 1907–1910; two different curves used for low and medium stages. It is probable that the extreme low discharge at Northville in 1910 is considerably too high.

Sacandaga River at Hadley.— Records at this station are unsatisfactory most of the time on account of frequent log jams at and below the gage section. No change made in published records of discharge, although they are at time subject to considerable error.

The comparisons are made by means of ratios. As a guide or index to the normal ratios of discharge, the ratios of the drainage areas are also given. All drainage area ratios are less than unity, that is, in their determination the area of the upstream station is used as the numerator. Natural or artificial causes entirely apart from errors involved in collecting and compiling stream-flow data may, of course, make the ratio of monthly mean discharge depart widely from the ratio of drainage area. The amount of probable departure depends primarily on the magnitude of the ratio of the drainage areas. If the drainage area ratio were unity, all departures of monthly mean ratios from the drainage area ratio would be due to errors in the records. If the drainage area ratio were very small, little significance could be attached to very wide departure of the monthly mean discharge ratio from the drainage area ratio. In general, unless the discharge is con-

trolled by artificial storage, the monthly mean discharge ratio should be lower than the drainage area ratio during the period when the streams are frozen, higher during the spring run-off, lower during the late summer and fall, higher during periods of high water, and lower during periods of low water. At certain times of the year the departure is likely to be considerable, on account of unequal distribution of precipitation and run-off. These inequalities are more evenly balanced over large areas than over small ones. Monthly mean discharge ratios greater than unity are of course due to error in the records. For long periods, such as a year or more, the discharge ratio, as a rule, should be very nearly the same as the drainage area ratio, although there are many notable exceptions to this rule, particularly for ratios less than about 0.60.

The preceding statements apply only to dependent streams, streams whose discharge in the numerator of the ratio is also included in the denominator. Natural variations in conditions affecting run-off in adjacent independent drainage areas are so great as usually to render ratio comparisons of discharge of little value.

In investigating apparent discrepancies in the monthly mean discharge ratios, consideration should be given to the relative amount of precipitation in the partial areas and also to natural and artificial conditions affecting the discharge.

In view of the small amount of money available and the difficulties of determining the discharge of the upper Hudson and its principal tributaries — the Schroon and the Sacandaga — it is believed that the records are very good. The flow of all these streams is affected by ice for nearly four months of the year, after which comes log driving with more or less flushing to drive the logs downstream. Logs are stranded or jam on the shoals and bars and in many places these log jams affect the relation of gage height to discharge for several months, necessitating very frequent measurements to determine the discharge accurately. Nearly all faulty determinations of monthly mean discharge are too high on account of backwater caused by ice or logs at or below stations.

The ratios show that many errors remain in the published records of discharge even after all possible care and attention have been given to their elimination. Some of the records are far from satisfactory even for preliminary studies, but under present conditions it is impossible to improve them.

The Survey's work in this region and also in other parts of the country emphasizes the need of larger funds for use in determining accurately the daily discharge of the Hudson and its tributaries at various points when the proposed storage reservoirs are completed, in order that water users on that river shall not be unjustly taxed for supposed benefits which they may not really receive.

For the purpose of properly regulating the discharge in future years, the records of discharge obtained at the dams on the Hudson would probably not be as satisfactory as records obtained at current-meter stations, first, on account of possible bias of the power users, and, second, because the involved character of the determinations of discharge at power plants and the many assumptions and hypothetical formulas used make many of them far from trustworthy. For discharge records already obtained at dams on

the Hudson, the reader is referred to the report of the New York State engineer and surveyor for 1910, pages 617 to 641. The two sets of records obtained at the Mechanicville stations appear good when compared with each other, but the records at Crockers Reef dam and Fort Edward appear very poor.

Comparisons, by monthly means, of discharge in the Hudson River drainage basin from 1904 to 1912.

	Hudson, North Creek	Schroon, River-bank	North Creek+ River-bank	Hudson, Thurman	Sacandaga: Wells	Sacandaga: North-ville	Sacandaga: Had-ley	Thurman+ Hadley	Hudson: Cor-inth	Hudson: Mechan-icville +Lake Cham-plain Canal a
Drainage area, sq. miles....	804	534	1,340	1,550	263	740	1,050	2,600	2,730	4,500
1904										
June	...	...	...	...	...	...	...	...	5,520	6,950
July	...	...	...	...	...	...	...	...	2,460	...
August	...	...	...	...	...	...	...	...	3,030	...
September	...	...	...	...	...	...	...	...	2,890	6,850
October	...	...	...	...	...	...	...	...	7,830	...
November	...	...	...	...	...	...	...	...	2,840	4,830
December	...	...	...	...	...	...	...	...	2,080	3,920
1905										
January	...	...	...	...	...	...	...	...	2,600	6,100
February	...	...	...	...	...	...	...	...	1,860	3,540
March	...	...	...	...	...	...	...	...	5,030	9,390
April	...	...	...	...	...	...	...	...	18,200	22,700
May	...	...	...	...	...	...	...	...	6,970	8,360
June	...	...	...	...	...	...	...	...	9,900	9,740
July	...	...	...	...	...	...	...	...	6,580	7,130
August	...	...	...	...	...	...	...	...	3,570	5,820
September	...	...	...	...	...	...	...	...	9,350	12,200
October	...	...	...	...	...	...	...	...	4,340	6,260
November	...	...	...	...	...	...	...	...	4,730	...
December	...	...	...	...	...	...	...	...	4,790	...
The year	...	...	...	...	...	...	...	...	6,490	...
1906										
January	...	...	...	...	...	...	...	...	6,400	9,310
February	...	...	...	...	...	...	...	...	3,950	7,650
March	...	...	...	...	...	...	...	...	4,580	9,000
April	...	...	...	...	...	...	...	...	16,200	20,600
May	...	...	...	...	...	...	...	...	10,400	13,600
June	...	...	...	...	...	...	...	...	6,120	9,480
July	...	...	...	...	...	...	...	...	3,880	5,970
August	...	...	...	...	...	...	...	...	2,020	3,670
September	...	...	...	...	...	...	...	...	1,870	3,260
October	...	...	...	...	...	...	...	...	2,210	3,560
November	...	...	...	...	...	...	...	...	3,150	5,320
December	...	...	...	...	...	...	...	...	2,380	4,870
The year	...	...	...	...	...	...	...	...	5,250	8,020
1907										
January	...	...	...	...	...	...	...	...	6,240	10,300
February	...	...	...	...	...	...	...	...	2,110	4,140
March	...	...	...	...	...	...	...	...	6,510	9,570
April	...	...	...	...	...	...	...	...	13,100	16,600
May	...	...	...	...	...	...	...	...	11,100	14,100
June	...	...	...	...	...	...	...	...	3,670	5,750
July	...	...	...	...	...	...	...	...	2,650	4,310
August	...	...	...	...	...	...	...	...	1,720	2,580
September	...	184	...	1,520	172	550	...	...	2,800	6,340
October	2,120	545	2,660	2,980	479	2,000	2,260	5,240	6,220	9,750
November	2,530	1,530	4,060	4,530	936	3,420	4,160	8,690	10,200	14,200
December	1,970	1,130	3,100	3,580	749	3,050	3,040	6,620	7,710	12,000
The year	...	...	...	...	...	...	...	...	6,190	9,140

a Canal assumed to be in operation May to November inclusive and to be carrying 190 second-feet.

Comparisons, by monthly means, of discharge in the Hudson River drainage basin from 1904 to 191 — Continued.

	Hudson, North Creek	Schroon, Riverbank	North Creek + Riverbank	Hudson, Thurman	Sacandaga: Wells	Sacandaga: Northville	Sacandaga: Hadley	Thurman + Hadley	Hudson: Corinth	Hudson: Mechanicville + Lake Champlain Canal [a]
1908										
January	1,300	1,010	2,310	2,620	450	1,430	1,900	4,520	5,320	8,410
February	2,020	1,130	3,150	3,630	724	2,660	3,420	7,050	6,070	9,690
March	2,730	1,300	4,030	4,750	844	2,860	3,480	8,230	9,630	14,000
April	5,270	3,160	8,430	8,520	2,250	9,600	10,200	18,700	19,800	22,300
May	5,230	2,790	8,020	7,900	1,550	6,040	7,440	15,300	16,300	18,100
June	818	700	1,520	1,700	292	862	1,300	3,000	2,760	3,950
July	830	335	1,160	1,410	65.1	252	382	1,790	2,060	2,330
August	742	117	859	943	29.2	144	233	1,180	1,940	1,960
September	525	160	685	728	18.4	63.9	138	866	1,580	1,210
October	532	159	691	779	66.9	208	367	1,150	1,970	1,570
November	626	195	821	919	112	389	521	1,440	2,060	2,040
December	570	198	768	900	262	446	637	1,540	1,810	2,010
The year	1,770	938	2,710	2,900	554	2,080	2,500	5,400	5,930	7,300
1909										
January	622	255	877	1,100	456	1,130	1,680	2,780	3,990	5,210
February	1,280	872	2,150	2,700	931	2,650	3,820	6,520	8,590	11,600
March	1,180	1,040	2,220	2,610	535	1,580	2,250	4,860	5,910	9,220
April	6,290	3,970	10,300	9,680	2,410	9,210	12,300	22,000	23,400	25,800
May	5,150	2,630	7,780	7,860	1,560	4,220	6,280	14,100	15,500	17,200
June	1,360	1,110	2,470	2,810	441	1,300	1,660	4,470	4,860	6,210
July	679	343	1,020	1,110	78.1	226	378	1,490	1,560	2,170
August	773	100	873	960	40.9	189	352	1,310	1,390	1,710
September	807	108	915	913	22.5	75.2	216	1,130	1,250	1,650
October	717	110	827	795	29.6	157	303	1,100	1,310	1,750
November	737	188	925	835	52.5	182	387	1,220	1,450	1,870
December	427	218	645	800	69.7	250	456	1,260	1,200	1,570
The year	1,670	912	2,580	2,680	546	1,760	2,510	5,190	5,820	7,160
1910										
January	593	188	781	900	368	900	1,120	2,020	2,490	5,190
February	677	363	1,040	1,200	300	750	1,020	2,220	2,410	5,480
March	3,640	1,910	5,550	6,500	1,800	5,300	7,710	14,200	16,000	21,400
April	3,560	2,780	6,340	6,810	1,420	4,600	6,070	12,900	14,900	17,600
May	2,380	1,700	4,080	3,950	949	2,630	3,540	7,490	8,880	9,420
June	1,840	1,400	3,240	3,800	826	2,240	3,640	7,440	8,820	10,400
July	508	260	768	819	64.5	245	358	1,180	1,450	1,790
August	956	186	1,140	1,220	160	367	465	1,680	1,820	2,180
September	986	348	1,330	1,420	307	520	611	2,030	2,270	2,460
October	1,130	368	1,500	1,590	262	600	696	2,290	2,420	2,730
November	910	399	1,310	1,490	320	850	1,130	2,620	2,740	3,470
December	570	219	789	860	120	350	543	1,400	1,540	2,010
The year	1,480	843	2,320	2,550	575	1,620	2,240	4,790	5,490	7,010
1911										
January	750	357	1,110	1,200	240	....	1,030	2,230	2,640	5,270
February	685	250	935	1,000	170	....	735	1,740	2,040	3,370
March	675	310	985	1,250	248	....	1,250	2,500	2,790	5,780
April	3,570	2,130	5,700	7,000	1,550	....	5,920	12,900	14,700	16,800
May	2,620	1,420	4,040	4,380	1,330	....	2,930	7,310	8,770	9,450
June	1,230	625	1,860	1,880	594	....	1,470	3,350	4,690	4,620
July	706	189	895	923	66.5	....	296	1,220	1,490	1,550
August	791	99.2	890	862	33.1	....	202	1,060	1,590	1,370
September	522	151	673	710	....	....	659	1,370	2,130	2,190
October	924	333	1,260	1,300	....	....	2,680	3,980	5,610	7,430
November	1,010	610	1,620	1,570	....	....	2,680	4,250	5,690	7,750
December	1,850	1,060	2,910	2,800	....	....	3,710	6,510	8,680	10,000
The year	1,280	628	1,910	2,070	....	....	1,970	4,040	5,060	6,300

[a] Canal assumed to be in operation May to November inclusive and to be carrying 190 second-feet.

Comparisons, by monthly means, of discharge in the Hudson River drainage basin from 1904 to 1912—Continued

	Hudson, North Creek	Schroon, Riverbank	North Creek + Riverbank	Hudson, Thurman	Sacandaga: Hope	Sacandaga: Hadley	Thurman + Hadley	Hudson: Corinth	Hudson: Mechanicville + Champlain Canal *a*
1912									
January	800	720	1,520	1,700	600	1,070	2,770	3,320	4,760
February	1,060	349	1,409	1,500	300	655	2,155	2,540	3,400
March	818	364	1,182	1,300	900	2,130	3,430	4,860	10,000
April	5,850	3,840	9,690	9,880	4,980	9,110	18,990	23,400	27,600
May	3,800	2,130	5,930	6,370	2,190	3,710	10,080	11,900	13,090
June	1,140	885	2,025	2,230	489	975	3,205	3,480	5,730
July	681	148	829	894	110	213	1,107	1,210	1,500
August	911	192	1,103	1,160	90.7	191	1,351	1,420	1,460
September	892	245	1,137	1,220	259	571	1,791	1,810	2,680
October	1,270	391	1,661	1,800	746	1,570	3,370	4,010	7,120
November	1,830	1,150	2,980	3,000	1,420	2,700	5,700	7,390	10,990
December	1,220	800	2,020	2,100	1,220	2,360	4,460	4,490	8,640
The year	1,690	931	2,621	2,750	1,110	2,100	4,850	5,820	8,060

a Canal assumed to be in operation, May to November, inclusive, and to be carrying 190 second-feet.

Comparisons, by monthly ratios, of discharge in the Hudson River drainage basin from 1904 to 1912

	North Creek + Riverbank / Thurman	Wells / Northville	Northville / Hadley	Thurman + Hadley / Corinth	Thurman + Hadley / Mechanicville	Corinth / Mechanicville
Drainage area ratio	0.86	0.36	0.70	0.95	0.58	0.61
1904						
June						.79
July						
August						
September						.42
October						
November						.59
December						
1905						
January						.43
February						.53
March						.54
April						.80
May						.83
June						1.02
July						.92
August						.61
September						.77
October						.69
November						
December						
1906						
January						.69
February						.52
March						.51
April						.79
May						.76
June						.65
July						.65
August						.55
September						.57
October						.62
November						.59
December						.49
The year						.65

Comparisons, by monthly ratios, of discharge in the Hudson River drainage basin from 1904 to 1912—Continued

	North Creek + River-bank / Thurman	Wells / Northville	Northville / Hadley	Thurman + Hadley / Corinth	Thurman + Hadley / Mechanic-ville	Corinth / Mechanic-ville
1907						
January	....	....	....	....	....	.61
February	....	....	....	....	....	.51
March	....	....	....	....	....	.68
April	....	....	....	....	....	.79
May	....	....	....	....	....	.79
June	....	....	....	....	....	.64
July	....	....	....	....	....	.61
August	....	....	....	....	....	.67
September	....	.31	....	....	....	.44
October	.89	.24	.88	.84	.54	.64
November	.90	.27	.82	.85	.61	.72
December	.87	.25	1.00	.86	.55	.64
The year	....	....	....	....	....	.68
1908						
January	.88	.31	.75	.85	.54	.63
February	.87	.27	.78	1.16	.73	.63
March	.85	.29	.83	.85	.59	.69
April	.99	.23	.94	.94	.84	.89
May	1.02	.26	.81	.94	.85	.90
June	89	.34	.66	1.09	.76	.70
July	.82	.26	.66	.87	.77	.88
August	.91	.20	.62	.61	.60	.99
September	.94	.29	.46	.55	.72	1.31
October	.89	.32	.57	.58	.73	1.25
November	.89	.29	.75	.70	.71	1.01
December	.85	.59	.70	.85	.77	.90
The year	.93	.27	.83	.91	.74	.81
1909						
January	.80	.40	.67	.70	.53	.77
February	.80	.35	.69	.76	.56	.74
March	.85	.34	.70	.82	.53	.64
April	1.06	.26	.75	.94	.85	.91
May	.99	.37	.67	.91	.82	.90
June	.88	.34	.78	.92	.72	.78
July	.92	.35	.60	.96	.69	.72
August	.91	.22	.54	.94	.77	.81
September	1.00	.30	.35	.90	.68	.76
October	1.04	.19	.52	.84	.63	.75
November	1.11	.29	.47	.84	.65	.78
December	.81	.28	.55	1.05	.80	.76
The year	.96	.31	.70	.89	.72	.81
1910						
January	.87	.41	.80	.81	.39	.48
February	.87	.40	.73	.92	.40	.44
March	.85	.34	.69	.89	.66	.75
April	.93	.31	.76	.87	.73	.85
May	1.03	.36	.74	.84	.80	.94
June	.85	.37	.62	.84	.71	.85
July	.94	.26	.68	.81	.66	.81
August	.93	.44	.79	.92	.77	.83
September	.94	.59	.85	.89	.83	.92
October	.94	.44	.86	.95	.84	.89
November	.88	.38	.75	.96	.75	.79
December	.92	.34	.64	.91	.70	.77
The year	.91	.36	.72	.87	.68	.78

Comparisons, by monthly ratios, of discharge in the Hudson River drainage basin from 1904 to 1912 — Continued

	North Creek + River-bank / Thurman	Wells / Northville	Northville / Hadley	Thurman + Hadley / Corinth	Thurman + Hadley / Mechanic-ville	Corinth / Mechanic-ville
1911						
January	.92	....	....	.84	.42	.50
February	.94	....	....	.85	.52	.61
March	.79	....	....	.90	.43	.48
April	.81	....	....	.88	.77	.88
May	.92	....	....	.83	.77	.93
June	.99	....	....	.71	.72	1.01
July	.97	....	....	.82	.79	.96
August	1.03	....	....	.67	.77	1.16
September	.95	....	....	.64	.63	.97
October	.97	....	....	.71	.54	.76
November	1.03	....	....	.75	.55	.73
December	1.04	....	....	.75	.65	.87
The year	.92	....	....	.80	.64	.80
1912						
January	.89	....	....	.83	.58	.70
February	.94	....	....	.85	.63	.75
March	.91	....	....	.71	.34	.49
April	.98	....	....	.81	.69	.85
May	.93	....	....	.85	.77	.91
June	.91	....	....	.92	.56	.61
July	.93	....	....	.92	.74	.81
August	.95	....	....	.95	.93	.97
September	.93	....	....	.99	.67	.68
October	.92	....	....	.84	.47	.56
November	.99	....	....	.77	.52	.67
December	.96	....	....	.99	.52	.52
The year	.95	....	....	.83	.60	.72

Hudson River at North Creek, N. Y.

Location.— At the highway bridge in the village of North Creek, immediately above the mouth of North creek, which enters the Hudson from the right.

Records available.— September 21, 1907, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 804 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Chain, read twice daily; datum unchanged.

Channel.— Heavy gravel; considered fairly permanent.

Discharge measurements.— Made from the two-span steel highway bridge.

Artificial control.— The numerous lakes and ponds in the basin of the upper Hudson have a decided effect on the low water flow, especially is this true of Indian lake.* The use of these storage reservoirs in the springs in connection with log-driving tends to vitiate the daily records at all the gaging stations. Where possible, allowance is made for the effect of logging operations.

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* See Indian lake at Indian lake, p. 342.

Winter flow.— Winters are severe in the northern part of the State and determinations of flow for the winter months are approximate because of ice.

Accuracy.— Discharge rating curve very well defined. Determinations of discharge for open water periods considered excellent.

Discharge measurements of Hudson River at North Creek, N. Y., 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 19*a*	Frank Weber	4.60	883
Feb. 8*a*	Frank Weber	4.89	1,090
Feb. 29*a*	Frank Weber	5.26	969
Mar. 14*a*	Frank Weber	5.03	821
Mar. 23*a*	Frank Weber	4.74	773
June 22	G. H. Canfield	2.52	466

a Measurement made under complete ice cover.

Daily gage height, in feet, of Hudson River at North Creek, N. Y., for 1912.
[Gilbert Dean, observer.]

DAY.	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.1	......	......	......	4.8	4.9	2.65	2.70	3.00	2.9	3.3	2.8
2	3.0	......	......	......	4.5	4.6	2.65	2.70	3.10	3.1	3.45	2.8
3	2.95	......	......	5.6	3.6	4.2	2.60	2.90	3.10	3.05	3.45	3.5
4	2.9	......	......	......	3.85	4.0	2.60	3.00	3.20	2.95	3.35	3.95
5	2.85	......	......	......	4.7	3.85	2.65	3.05	3.20	2.8	3.25	3.85
6	3.95	......	5.2	5.6	4.1	3.65	2.65	3.05	3.20	2.75	3.15	3.8
7	......	4.8	......	6.0	4.4	3.55	2.65	3.00	3.20	2.7	3.1	4.0
8	......	4.9	......	6.7	3.65	3.40	2.60	3.00	3.30	2.65	4.7	4.0
9	......	......	......	6.4	4.3	3.1	2.95	3.00	3.20	2.75	5.4	3.7
10	4.4	......	......	5.8	3.85	3.25	3.05	3.00	3.10	2.9	5.1	3.55
11	......	......	......	5.2	4.3	3.1	2.85	3.00	3.00	2.95	4.7	3.45
12	......	......	......	4.8	3.8	3.15	2.80	3.05	2.95	3.1	4.3	3.3
13	......	......	4.8	4.6	4.6	3.05	2.80	3.05	2.95	3.3	4.0	3.1
14	......	4.8	5.0	4.7	5.6	2.95	2.85	3.15	2.90	3.6	3.95	3.05
15	......	......	......	4.9	4.6	2.75	2.85	3.10	2.90	3.7	4.1	3.0
16	......	......	......	6.7	5.4	2.75	2.80	3.10	3.00	3.55	4.1	3.0
17	3.8	......	......	8.2	6.0	2.75	2.75	3.05	3.05	3.25	3.95	2.9
18	......	......	......	8.0	5.0	2.75	2.75	3.00	3.05	3.0	3.75	2.85
19	4.6	......	......	7.7	4.9	2.7	2.75	3.00	3.15	2.9	3.55	3.0
20	......	......	5.0	7.0	4.7	2.6	2.75	3.00	2.80	2.8	3.6	3.4
21	......	4.8	......	6.4	5.7	2.6	2.75	3.00	2.70	2.75	3.7	3.45
22	......	......	......	6.3	6.6	2.55	2.95	3.05	2.90	2.65	3.5	3.4
23	......	......	4.7	7.1	6.2	2.5	2.95	3.05	2.85	2.65	3.3	3.3
24	4.3	......	......	6.8	6.0	2.75	2.95	3.05	2.80	3.1	3.2	3.15
25	......	......	......	6.1	5.5	2.75	2.90	3.05	2.80	4.6	3.2	3.1
26	......	......	......	5.3	4.9	2.75	2.80	3.00	2.95	4.7	3.1	3.0
27	......	......	4.4	5.2	4.6	2.75	2.80	3.05	3.05	4.5	3.0	2.95
28	......	......	......	5.2	4.3	2.65	2.75	3.15	2.95	4.2	3.0	2.9
29	......	5.3	......	5.4	4.2	2.7	2.75	3.15	2.80	3.9	2.9	2.85
30	......	......	......	4.6	4.8	2.65	2.75	3.10	2.75	3.6	2.8	2.9
31	4.5	......	......	......	5.1	......	2.70	3.05	......	3.45	......	2.9

NOTE.— Relation of gage height to discharge affected by ice January 6 to April 5.

Daily Discharge, in second-feet, of Hudson River at North Creek, N. Y., for 1912.

DATE.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	3,680	3,880	570	610	890	790	1,220	700
2	......	3,100	3,290	570	610	990	990	1,420	700
3	......	1,620	2,570	530	790	990	940	1,420	1,480
4	......	2,000	2,240	530	890	1,100	840	1,280	2,160
5	......	3,480	2,000	570	940	1,100	700	1,160	2,000
6	5,440	2,400	1,700	570	940	1,100	655	1,040	1,920
7	6,430	2,920	1,550	570	890	1,100	610	990	2,240
8	8,330	1,700	1,350	530	890	1,220	570	3,480	2,240
9	7,490	2,740	990	840	890	1,100	655	4,970	1,770
10	5,930	2,000	1,160	940	890	990	790	4,300	1,550
11	4,520	2,740	990	745	890	890	840	3,480	1,420
12	3,680	1,920	1,040	700	940	840	990	2,740	1,220
13	3,290	3,290	940	700	940	840	1,220	2,240	990
14	3,480	5,440	840	745	1,040	790	1,620	2,160	940
15	3,880	3,290	655	745	990	790	1,770	2,400	890
16	8,330	4,970	655	700	990	890	1,550	2,400	890
17	12,900	6,430	655	655	940	940	1,160	2,160	790
18	12,300	4,090	655	655	890	940	890	1,840	745
19	11,300	3,880	610	655	890	1,040	790	1,550	890
20	9,200	3,480	530	655	890	700	700	1,620	1,350
21	7,490	5,680	530	655	890	610	655	1,770	1,420
22	7,220	8,050	495	840	940	790	570	1,480	1,350
23	9,490	6,950	460	840	940	745	570	1,220	1,220
24	8,620	6,430	655	840	940	700	990	1,100	1,040
25	6,690	5,200	655	790	940	700	3,290	1,100	990
26	4,740	3,880	655	700	890	840	3,480	990	890
27	4,520	3,290	655	700	940	940	3,100	890	840
28	4,520	2,740	570	655	1,040	840	2,570	890	790
29	4,970	2,570	610	655	1,040	700	2,080	790	745
30	3,290	3,680	570	655	990	655	1,620	700	790
31	......	4,300	......	610	940	......	1,420	......	790

NOTE.— Daily discharge determined from a well defined rating curve.

Monthly discharge of Hudson River at North Creek, N. Y., for 1912.

[Drainage area, 804 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.
January	....	....	800	.995	1.15
February	....	....	1,060	1.32	1.42
March	....	....	818	1.02	1.18
April	12,900	800	5,850	7.28	8.12
May	8,050	1,620	3,800	4.73	5.45
June	3,880	460	1,140	1.42	1.58
July	940	530	681	.847	.98
August	1,040	610	911	1.13	1.30
September	1,220	610	892	1.11	1.24
October	3,480	570	1,270	1.58	1.82
November	4,970	700	1,830	2.28	2.54
December	2,240	700	1,220	1.52	1.75
The year	12,900	....	1,690	2.10	28.53

NOTE.— Discharge January 6 to March 5, estimated by means of 5 measurements made with ice present, climatologic records, consideration of storage and comparison of the discharge with that at other stations.

Mean discharge, January 6 to 31, estimated 790 second-feet.

Mean discharge, April 1 to 5, estimated 1,540 second-feet.

Hudson River at Thurman, N. Y.

Location.— At the Delaware and Hudson Railroad bridge leading from Thurman to Warrensburg, about 950 feet below the highway bridge to Warrensburg, about 2,000 feet below the mouth of Schroon river, and about 13 miles above the month of Sacandaga river, which enters from the right.

Records available.— September 1, 1907, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 1,550 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Chain; read three times daily; datum unchanged.

Channel.— Sand and gravel, liable to shift.

Discharge measurements.— Made from the bridge.

Artificial control.— The influence of storage at Indian Lake and of mill control on Schroon river is observable at this station.

Winter flow.— Winter flow estimated from the determinations of combined flow at River-bank and North Creek plus an estimated inflow between the two stations.

Accuracy.— Accuracy of the determinations to some extent impaired as the result of accumulations of logs at the control point below the section and also around the piers of the bridge. Discharge rating curve very well defined and determinations of flow during the open water season are considered fairly accurate.

Co-operation.— Station established and maintained in co-operation with the United States Geological Survey. Gage heights January to March and December furnished by Albany office of United States Weather Bureau.

Discharge measurements of Hudson River at Thurman, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 21	G. H. Canfield	2.87	1,190
June 28	G. H. Canfield	2.80	1,110
July 4	G. H. Canfield	2.32	616
Aug. 1	J. G. Mathers	2.54	796

Daily gage height, in feet, of Hudson River at Thurman, N. Y., for 1912.
[S. H. Spencer, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	5.4	5.2	5.8	5.2	4.8	2.7	2.5	2.65	2.85	3.4	3.1
2	6.2	5.4	5.1	5.6	4.9	4.6	2.48	2.46	2.95	3.05	3.4	3.0
3	6.5	5.5	5.1	5.4	4.7	4.4	2.46	2.55	3.0	2.95	3.4	3.7
4	6.5	5.6	5.1	5.1	3.85	4.1	2.34	2.6	3.1	2.85	3.4	3.9
5	6.2	5.6	5.2	5.0	5.0	4.0	2.55	2.9	2.95	2.8	3.3	3.9
6	5.5	5.4	5.1	5.4	3.85	3.8	2.47	2.8	2.95	2.38	3.2	3.8
7	5.4	5.4	5.2	6.7	4.7	3.75	2.31	2.8	3.0	2.8	3.2	4.0
8	5.9	5.3	5.2	6.7	3.85	3.6	2.65	2.85	2.85	2.7	4.6	4.0
9	6.0	5.3	5.1	6.7	4.2	3.05	2.50	2.85	3.0	2.75	5.0	3.7
10	6.2	5.3	5.1	6.4	4.2	3.35	3.0	2.95	2.95	2.85	4.8	3.6
11	5.8	5.3	5.1	6.0	4.0	3.25	2.7	2.65	2.85	3.0	4.5	3.5
12	5.5	5.4	5.1	5.6	4.1	3.35	2.65	2.95	2.8	2.95	4.2	3.4
13	5.3	5.3	5.2	5.4	4.8	3.15	2.55	3.0	2.8	2.85	4.1	3.3
14	5.3	5.3	5.2	5.4	5.3	3.15	2.50	3.0	2.75	3.4	4.0	3.2
15	5.4	5.1	5.1	5.5	5.0	2.95	2.8	2.9	2.55	3.5	4.2	3.1
16	5.3	5.1	5.2	6.7	5.1	2.7	2.7	2.9	3.05	3.35	4.2	3.1
17	5.4	5.1	5.3	7.9	4.8	3.0	2.65	2.8	3.05	3.2	4.1	3.0
18	5.8	5.1	5.4	8.0	4.7	3.0	2.6	2.65	3.0	2.85	4.0	3.0
19	5.8	5.0	5.3	7.9	4.7	3.0	2.55	2.85	3.1	2.75	3.8	3.2
20	5.6	5.0	5.5	7.4	4.6	2.95	2.55	2.8	2.95	2.6	3.65	3.3
21	5.4	5.0	5.3	6.8	5.2	2.85	2.50	2.85	2.75	2.8	3.7	3.5
22	5.4	5.2	5.1	6.6	6.2	2.8	2.8	2.9	2.50	2.65	3.6	3.4
23	5.3	5.2	4.9	7.5	6.0	2.32	2.75	2.9	3.0	2.75	3.45	3.4
24	5.3	5.3	4.9	7.0	5.7	2.95	2.75	2.9	2.8	3.4	3.35	3.2
25	5.3	5.2	4.6	6.6	5.6	3.0	2.65	2.65	2.8	4.3	3.4	3.0
26	5.3	5.2	4.6	5.9	5.1	2.85	2.6	3.0	2.8	4.3	3.3	3.0
27	5.5	5.2	4.5	6.2	4.9	2.8	2.6	2.95	2.9	4.2	3.2	3.0
28	5.3	5.3	4.6	5.7	4.6	2.85	2.6	3.0	2.9	3.95	3.1	3.1
29	5.7	5.2	4.6	5.8	4.4	2.8	2.7	2.95	2.46	3.75	3.0	3.1
30	5.5	......	4.7	5.2	4.8	2.38	2.6	2.95	2.9	3.5	3.1	3.1
31	5.5	......	5.3	......	5.0	......	2.55	2.8	......	3.45	......	3.2

NOTE.— Relation of gage height to discharge affected by ice January 1 to about April 5.
A log jam formed June 17 and caused some backwater at the gage for the remainder of the year. There were other log jams before June 17, but apparently they did not affect the gage heights.

Daily discharge, in second-feet, of Hudson River at Thurman, N. Y., for 1912.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	7,520	6,320	990	770	935	1,180	2,150	1,560
2	......	6,620	5,730	752	734	1,320	1,470	2,150	1,390
3	......	6,020	5,150	734	825	1,390	1,320	2,150	2,840
4	......	3,610	4,290	632	880	1,560	1,180	2,150	3,330
5	......	6,920	4,010	825	1,240	1,320	1,110	1,940	3,330
6	8,120	3,610	3,480	743	1,110	1,320	664	1,740	3,080
7	12,000	6,020	3,360	608	1,110	1,390	1,110	1,740	3,590
8	12,000	3,610	2,990	935	1,180	1,180	990	5,290	3,590
9	12,000	4,570	1,760	770	1,180	1,390	1,050	6,470	2,840
10	11,100	4,570	2,400	1,390	1,320	1,320	1,180	5,870	2,600
11	9,920	4,010	2,180	990	935	1,180	1,390	5,000	2,370
12	8,720	4,290	2,400	935	1,320	1,110	1,320	4,140	2,150
13	8,120	6,320	1,960	825	1,390	1,110	1,180	3,860	1,940
14	8,120	7,820	1,960	770	1,390	1,050	2,150	3,590	1,740
15	8,420	6,920	1,560	1,110	1,240	825	2,370	4,140	1,560
16	12,000	7,220	1,140	990	1,240	1,480	2,040	4,140	1,560
17	15,600	6,320	1,390	935	1,110	1,480	1,740	3,860	1,390
18	15,900	6,020	1,390	880	935	1,390	1,180	3,590	1,390
19	15,600	6,020	1,390	825	1,180	1,560	1,050	3,080	1,740
20	14,100	5,730	1,320	825	1,110	1,320	880	2,720	1,940
21	12,300	7,520	1,180	770	1,180	1,050	1,110	2,840	2,370
22	11,700	10,500	1,110	1,110	1,240	770	940	2,600	2,150
23	14,400	9,920	616	1,050	1,240	1,390	1,050	2,260	2,150
24	12,900	9,020	1,320	1,050	1,240	1,110	2,150	2,040	1,740
25	11,700	8,720	1,390	935	935	1,110	4,420	2,150	1,390
26	9,620	7,220	1,180	880	1,390	1,110	4,420	1,940	1,390
27	10,500	6,620	1,110	880	1,320	1,240	4,140	1,740	1,390
28	9,020	5,730	1,180	880	1,390	1,240	3,460	1,560	1,560
29	9,320	5,150	1,110	990	1,320	734	2,960	1,390	1,560
30	7,520	6,320	664	880	1,320	1,240	2,370	1,560	1,560
31	......	6,920	......	825	1,110	......	2,260	......	1,740

NOTE.— Daily discharge April 6 to June 16, determined from a fairly well defined rating curve. Daily discharge June 17 to December 31, determined from a fairly well defined rating curve based on measurements made during the existence of the log jam.

Monthly discharge of Hudson River at Thurman, N. Y., for 1912.
[Drainage area, 1,550 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	1,700	1.10	1.27	C
February	....	....	1,500	.968	1.04	C
March	....	....	1,300	.839	.97	C
April	15,900	1,650	9,880	6.37	7.11	B
May	10,500	3,610	6,370	4.11	4.74	B
June	6,320	616	2,230	1.44	1.61	B
July	1,390	608	894	.577	.67	B
August	1,390	734	1,160	.748	.86	B
September	1,560	770	1,220	.787	.88	B
October	4,420	664	1,800	1.16	1.34	B
November	6,470	1,390	3,000	1.94	2.16	B
December	3,590	1,390	2,100	1.35	1.56	B
The year	15,900	608	2,750	1.77	24.21	

NOTE.— Discharge Jan. 1 to April 5 estimated from the combined discharge of Schroon river and Hudson river at North Creek, considering the probable inflow between North Creek and Thurman.
Mean discharge April 1 to 5 estimated 3,110 second-feet.

Hudson River at Corinth, N. Y.

Location.— One-half mile upstream from highway bridge crossing the Hudson at Corinth and one-half mile north of the Corinth post-office, at the mouth of the second brook, upstream, tributary to the Hudson from the right; five miles by river below the village of Luzerne and one and one-half miles above the dam of the International Paper Company at Palmer Falls.

Records available.— June 1, 1904, to December 31, 1912.

Drainage area.— 2,760 square miles. The figure used for computation 1904–1911 inclusive was 2,730. The revised figures are from United States Geological Surrery Topographic Sheets.

Gage.— Vertical staff bolted to the left-hand abutment on the downstream side of the highway bridge over the brook. The gage is about 25 feet from low-water line in Hudson river, but as there is practically no slope to the tributary stream low-water readings can be considered fair. The zero of the gage, unchanged since established, is at the same elevation as the crest of the Palmer Falls dams, which is assumed as 100 feet.

Channel.— Permanent; composed of coarse gravel and bowlders; fairly straight for upward of two miles above the gage, and current sluggish. The river begins to bend to the left almost at the gage and in the next 1,000 feet turns nearly 90°, then flows straight for 200 or 300 feet to the head of a rocky reef, which is practically a control for the gage. In the 1,000 feet between the point of control and the three-span steel highway bridge that crosses the Hudson at this point the river falls three or four feet.

Discharge measurements.— At low and medium stages made from a boat or by wading just above the point of control and about 1,100 feet downstream from the gage; at high stages from the upstream side of the highway bridge.

Winter flow.— Ice forms in the river to a thickness of two or three feet in the vicinity of the gage and down to within 500 feet of the control. In a section at the control, however, the river is usually open and it is believed that there is no very marked effect from ice.

Artificial control.— The low-water flow is modified by release of stored water from Indian lake and to some extent by release of water from other small ponds on the upper Hudson. The only dam on the main stream above the station is that which furnishes power to a paper mill at Luzerne, five miles above. Below the bridge and on the left-hand side of the stream is a low dam built in November, 1905, by the Corinth Electric Power Company, to divert water to a small electric plant which furnishes light and power for the villages of Corinth and Palmer Falls. In September, 1909, a temporary brush dam was built at this point by the same company. The dam of the International Paper Company is about one-half mile farther downstream. Neither dam affects the records at the gage.

Point of zero flow.— Soundings near the point of control indicate that there would be no flow past the gage if the water fell below 123 feet on the gage.

Accuracy.— Conditions are not entirely favorable for accurate determination of flow. During the greater part of the time log jams rest against the two bridge piers and often extend upstream above the point of control, causing back water at the gage. Construction work on the temporary brush dam in the fall of 1909 may have produced a slight effect at the gage. The discharge curve has been developed from measurements made by engineers of the United States Geological Survey and probably represents the discharge at the station fairly well for conditions unaffected by log jams or ice.

Co-operation.— Gage installed and gage heights furnished by the International Paper Company.

Discharge measurements of Hudson River at Corinth, N. Y., in 1905 to 1910.

DATE.	Hydrographer.	Gage height.	Discharge.	DATE.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1910.		*Feet.*	*Sec.-ft.*
Sept. 11	C. C. Covert	125.90	1,670	Mar. 2	C. C. Covert	130.04	[a] 19,100
12	do	125.82	1,730	3	do	130.66	[a] 21,900
Nov. 1	do	126.12	[a] 2,580	4	do	130.62	[a] 22,100
				7	do	129.93	[a] 15,900
1909.				9	E. H. Sargent	129.71	[a] 17,100
June 19	C. C. Covert	127.02	[a] 5,770	Apr. 22	W. G. Hoyt	128.90	[a] 13,800
July 20	do	125.50	1,250	June 20	J. J. Phelan	127.62	6,820
Aug. 25	W. G. Hoyt	125.35	1,100	Aug. 10	Phelan and Carman	125.54	1,540
				Oct. 28	J. J. Phelan	126.68	2,950

[a] Measurements made from highway bridge. All other measurements made at boat section above bridge.

Daily gage heights, in feet, of Hudson River at Corinth, N. Y., for 1904–1912.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1	....	....	....	....	....	127.41	127.06	125.96	125.76	128.00	127.08	125.98
2	....	....	....	....	....	126.96	126.51	125.96	125.84	127.88	126.82	125.82
3	....	....	....	....	....	126.71	126.21	125.96	126.02	127.50	126.72	125.85
4	....	....	....	....	....	126.51	126.11	125.96	126.22	127.26	126.68	125.70
5	....	....	....	....	....	126.76	126.31	125.96	126.32	127.02	126.59	125.88
6	....	....	....	....	....	126.96	126.46	126.96	126.22	126.78	126.40	125.92
7	....	....	....	....	....	128.11	126.31	126.76	126.20	126.55	126.45	125.99
8	....	....	....	....	....	127.01	126.16	126.26	126.10	126.35	126.39	125.94
9	....	....	....	....	....	128.76	126.01	125.91	126.02	126.28	126.28	125.94
10	....	....	....	....	....	128.76	125.86	125.81	126.02	126.35	126.20	125.84
11	....	....	....	....	....	128.81	125.96	125.81	125.95	126.95	126.22	125.82
12	....	....	....	....	....	128.56	125.91	125.76	125.98	127.36	126.35	125.75
13	....	....	....	....	....	128.06	126.21	125.66	125.92	127.30	126.20	125.84
14	....	....	....	....	....	127.66	126.36	125.66	125.88	127.28	126.21	125.82
15	....	....	....	....	....	127.31	126.16	125.71	126.11	126.95	126.12	125.80
16	....	....	....	....	....	127.11	126.11	125.66	126.15	126.74	126.15	125.78
17	....	....	....	....	....	126.91	126.01	125.66	125.89	126.60	126.08	125.76
18	....	....	....	....	....	126.61	126.01	125.66	126.08	126.55	126.05	125.78
19	....	....	....	....	....	126.41	125.86	125.66	126.18	126.32	126.08	125.78
20	....	....	....	....	....	126.21	125.86	125.46	126.08	126.30	125.92	125.76
21	....	....	....	....	....	126.26	125.76	127.51	126.06	126.85	125.95	125.82
22	....	....	....	....	....	126.26	125.66	127.66	126.10	130.40	125.85	125.79
23	....	....	....	....	....	126.26	125.66	127.82	126.10	130.84	125.92	125.78
24	....	....	....	....	....	126.16	125.66	127.49	126.08	130.12	126.12	125.90
25	....	....	....	....	....	126.06	125.76	127.02	126.14	129.40	126.18	125.82
26	....	....	....	....	....	125.96	125.76	126.59	126.90	128.88	126.19	125.81
27	....	....	....	....	....	125.96	125.91	126.32	127.07	128.40	125.78	125.92
28	....	....	....	....	....	125.96	125.91	126.06	126.97	128.05	125.90	126.38
29	....	....	....	....	....	126.01	126.31	125.94	126.76	127.88	125.78	126.50
30	....	....	....	....	....	126.26	126.21	125.82	127.45	127.45	125.88	126.42
31	....	....	....	....	....	....	126.11	125.69	....	127.22	....	126.43
1905.												
1	126.45	125.90	125.77	133.60	128.51	126.49	128.02	127.92	126.14	126.60	126.62	127.05
2	126.52	125.94	125.80	132.90	128.80	126.42	128.52	127.63	126.10	126.58	127.09	126.87
3	126.50	125.91	125.78	131.82	128.11	126.27	129.72	127.26	126.94	126.56	127.17	127.44
4	126.41	125.85	125.79	130.98	128.49	126.19	129.94	126.95	128.50	126.54	127.16	127.95
5	126.18	125.79	125.77	131.00	128.18	126.05	129.40	126.70	130.02	126.46	127.16	127.83
6	125.92	125.83	125.77	131.58	128.02	126.16	129.11	126.40	130.03	126.36	127.20	127.74
7	126.10	125.82	125.74	131.50	127.82	126.58	128.50	126.38	129.73	126.27	127.41	127.72
8	126.28	125.84	125.74	130.80	127.76	127.18	128.08	126.63	129.16	126.28	127.70	127.50
9	126.39	125.84	125.76	130.05	127.88	128.20	127.61	126.57	128.65	126.28	127.54	127.38
10	126.36	125.82	125.76	129.55	127.74	129.07	127.42	126.46	123.14	126.21	127.56	127.14
11	126.32	125.82	125.76	129.50	127.73	127.98	127.06	126.30	127.72	126.01	127.22	126.74
12	126.28	125.82	125.74	129.98	127.52	127.65	127.05	126.22	127.61	126.50	126.96	126.52
13	126.27	125.88	125.74	130.08	127.56	127.78	126.84	126.14	127.78	127.68	126.95	126.64
14	126.26	125.81	125.74	130.08	127.42	127.96	126.69	126.13	127.46	127.40	126.96	126.56
15	126.19	125.80	125.74	129.88	127.06	127.67	126.56	126.17	127.15	127.10	126.88	126.22
16	126.18	125.80	125.72	129.65	127.66	127.27	126.52	126.58	126.96	126.89	126.82	126.08
17	126.19	125.80	125.70	129.20	127.32	126.98	126.42	127.28	126.90	126.78	126.78	126.06
18	126.16	125.80	125.72	128.70	127.35	128.70	126.54	127.06	127.56	126.62	126.68	126.06
19	126.12	125.78	125.74	128.28	127.18	128.88	126.66	126.82	128.63	126.60	126.54	126.16
20	126.12	125.82	126.35	127.92	127.10	129.48	126.65	126.44	128.83	126.96	126.38	126.40
21	126.08	125.80	126.52	128.05	127.03	129.88	126.48	126.36	129.42	127.30	126.20	126.46
22	126.08	125.84	126.63	129.52	127.18	130.18	126.32	126.15	128.99	127.22	126.20	126.63
23	125.96	125.80	126.58	129.72	126.83	129.72	126.14	126.06	128.52	127.12	126.22	126.94
24	125.91	125.80	126.56	129.60	126.76	129.11	126.10	125.98	128.08	126.95	126.26	126.80
25	125.89	125.78	126.72	129.32	126.53	128.52	126.24	125.90	127.66	126.82	126.27	126.54
26	125.92	125.78	127.20	128.78	126.72	128.48	126.17	125.84	127.34	126.70	126.29	126.50
27	125.86	125.80	128.02	128.78	126.72	129.16	126.06	125.72	127.10	126.57	126.29	126.44
28	125.84	125.78	123.88	128.28	126.74	129.29	126.04	125.72	126.95	126.48	126.26	126.37
29	125.84	....	....	128.10	126.76	128.96	125.99	125.66	126.82	126.77	126.28	126.43
30	125.92	....	130.70	128.22	126.48	128.43	127.22	125.71	126.72	126.68	127.22	126.94
31	125.91	....	132.50	....	126.46	....	127.56	126.00	....	126.57	....	127.12

Daily gage height, in feet, of Hudson River at Corinth, N. Y., for 19[illegible]-1912 — Contd.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	*Nov.	Dec.
1906.												
1	127.05	127.41	126.66	127.84	128.40	128.17	127.70	126.19	125.85	125.74	126.12	126.72
2	126.90	127.18	126.58	127.83	128.50	127.96	128.30	126.16	125.70	125.82	126.04	126.44
3	126.70	126.60	126.60	127.85	128.95	127.45	127.96	126.04	125.76	125.80	125.96	126.12
4	126.64	126.52	127.56	128.03	128.81	127.30	127.66	125.93	125.78	125.82	125.88	125.94
5	127.00	126.61	127.77	128.42	129.00	126.84	127.56	125.84	126.06	125.74	125.89	126.02
6	127.06	126.48	127.54	128.34	128.62	127.09	127.44	126.08	126.18	125.74	125.81	126.02
7	126.92	126.42	127.42	128.26	128.42	127.02	127.14	125.98	126.00	125.66	125.82	126.08
8	126.66	126.48	127.24	128.08	128.32	127.04	126.81	125.91	125.95	125.69	125.78	125.92
9	126.51	126.44	127.12	127.98	128.28	127.64	126.66	125.86	125.98	125.72	125.76	125.82
10	126.35	126.52	126.88	127.68	128.28	128.20	126.64	125.81	126.00	125.69	125.76	125.84
11	126.42	126.48	126.80	127.49	128.18	128.59	126.66	125.78	125.92	125.74	125.75	125.90
12	126.58	126.54	126.69	127.62	127.84	128.26	126.60	125.68	125.80	125.78	125.85	125.89
13	126.63	126.48	126.67	127.99	127.94	127.51	126.44	125.73	125.78	125.78	125.88	125.85
14	126.53	126.52	126.58	128.57	128.40	127.32	126.32	125.68	125.80	125.80	125.89	125.86
15	126.40	126.44	126.54	130.36	128.90	126.80	126.19	125.64	125.78	125.80	125.92	125.89
16	126.55	126.40	126.36	131.16	128.24	126.61	126.10	125.60	125.70	125.78	125.88	125.97
17	126.60	126.36	126.38	131.72	127.84	126.74	126.02	125.60	125.75	125.76	125.90	126.20
18	126.52	126.32	126.25	131.74	127.85	127.27	126.02	125.65	125.78	125.75	125.95	126.35
19	126.47	126.30	126.24	131.78	128.04	127.26	125.99	125.62	125.75	125.74	126.12	126.28
20	126.43	126.33	126.24	131.85	127.56	127.04	125.90	125.72	125.78	125.95	126.66	126.14
21	126.40	126.36	126.25	131.84	127.23	126.80	125.84	125.80	125.78	126.51	126.89	126.10
22	126.59	126.54	126.26	131.76	127.30	126.74	125.93	125.92	125.74	126.55	127.06	126.18
23	127.80	126.67	126.29	131.56	126.92	126.93	125.86	126.10	125.74	126.33	127.30	126.18
24	129.54	126.82	126.18	130.96	127.34	127.04	125.90	126.13	125.79	126.17	127.18	126.02
25	129.35	126.82	126.18	130.44	127.76	126.97	125.88	126.10	125.85	126.14	126.99	126.00
26	129.28	126.93	126.12	129.95	127.62	126.84	125.84	126.00	125.78	126.30	126.82	125.98
27	129.08	127.02	126.20	129.28	128.04	126.68	125.80	126.08	125.78	126.36	126.76	125.95
28	128.69	126.86	126.90	128.88	129.20	126.48	125.90	125.98	125.74	126.33	126.96	125.95
29	128.20	....	127.40	128.66	128.92	126.38	125.98	126.08	125.70	126.35	126.97	125.94
30	127.82	....	127.56	128.42	128.96	126.44	126.09	126.05	125.70	126.28	126.79	125.90
31	127.62	....	127.91	....	128.54	....	126.15	125.94	....	126.18	....	126.10
1907.												
1	127.63	125.94	125.71	132.38	130.53	127.76	126.16	125.90	125.56	127.11	128.02	126.41
2	128.18	125.93	125.70	131.35	130.47	127.06	126.40	125.89	125.58	127.60	127.66	126.42
3	128.00	126.00	125.68	130.43	130.20	126.62	126.58	125.87	125.64	126.83	128.78	126.28
4	129.18	125.98	125.68	129.74	130.30	126.50	126.61	125.76	126.06	126.56	129.30	126.22
5	128.60	126.08	125.72	129.45	130.04	126.44	127.00	125.80	126.82	126.78	129.20	125.96
6	128.76	126.12	125.70	129.39	130.15	126.71	127.39	125.82	126.98	126.84	128.88	126.06
7	128.68	126.10	125.67	129.02	130.02	127.18	127.28	125.78	126.57	126.75	130.71	126.22
8	128.68	126.10	125.64	128.80	129.42	127.10	126.16	125.74	126.30	127.00	131.25	126.16
9	128.38	126.04	125.62	128.50	129.40	127.00	126.08	125.74	126.07	128.53	131.14	126.18
10	128.19	126.01	125.60	128.24	129.08	127.72	125.97	125.74	126.04	128.60	130.50	126.93
11	127.60	126.20	125.64	127.94	128.68	126.57	125.88	125.66	126.01	128.63	129.88	127.80
12	127.71	126.10	125.59	127.80	128.40	126.44	125.96	125.66	126.40	128.04	129.30	129.24
13	127.40	125.95	125.60	127.74	128.18	126.41	125.94	125.67	127.24	127.72	128.78	128.82
14	127.22	125.94	125.63	127.76	127.88	126.34	125.92	125.69	127.06	127.50	128.32	128.44
15	127.06	125.94	125.80	127.82	127.88	126.33	125.89	125.59	126.62	127.23	127.92	128.06
16	126.75	125.96	126.00	127.72	127.58	126.52	125.84	125.62	126.38	126.96	127.57	127.94
17	126.36	125.94	126.25	127.58	127.88	126.28	125.82	125.62	126.07	126.76	127.28	127.81
18	126.30	125.91	126.45	127.46	128.10	126.10	125.82	125.59	125.88	126.60	127.12	127.58
19	126.35	125.92	126.54	127.32	127.46	126.00	125.80	125.64	125.73	126.45	127.00	127.36
20	126.62	125.88	126.50	127.24	127.40	126.09	125.76	125.90	125.66	126.35	126.83	127.28
21	126.49	125.85	126.49	127.07	127.36	126.40	125.68	125.92	125.60	126.38	126.73	127.32
22	126.42	125.79	126.60	126.98	127.10	126.44	125.63	125.88	125.55	126.40	126.81	127.04
23	126.40	125.79	127.36	127.00	127.26	126.24	125.67	125.84	125.72	126.31	126.84	127.02
24	126.30	125.78	128.30	128.11	127.26	125.97	125.94	125.86	125.96	126.21	126.80	128.53
25	126.18	125.81	128.10	128.98	127.00	126.01	126.16	125.78	126.14	126.17	126.75	128.66
26	126.22	125.78	128.36	129.48	126.73	126.02	126.24	125.75	126.20	126.14	126.70	128.64
27	126.22	125.72	128.48	130.42	126.90	126.02	126.16	125.82	126.16	126.08	126.60	128.44
28	126.16	125.73	129.72	130.36	127.40	126.03	126.01	125.76	126.12	127.25	126.60	128.40
29	126.10	....	130.92	130.44	127.35	126.00	125.99	125.74	126.22	128.92	126.56	128.44
30	126.08	....	132.28	130.40	127.63	126.04	125.98	125.62	126.68	128.79	126.50	128.50
31	126.48	....	132.94	....	127.10	....	125.96	125.57	....	128.48	....	128.85

Daily gage height, in feet, of Hudson River at Corinth, N. Y., for 1904–1912 — Contd.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	128.88	126.10	126.89	130.98	132.32	127.12	125.78	126.02	125.74	126.09	125.92	126.26
2	128.68	126.04	126.80	130.58	132.34	127.13	125.75	125.89	125.68	126.08	125.90	126.14
3	128.46	126.16	126.88	129.70	132.40	126.99	125.72	125.83	125.68	126.00	125.81	125.79
4	128.25	126.08	126.96	129.50	131.49	126.79	125.84	125.90	125.65	125.86	125.73	125.68
5	127.90	126.10	126.90	128.98	131.62	126.63	125.97	125.90	125.62	125.86	125.72	125.66
6	127.26	126.28	126.84	128.81	130.46	126.55	125.87	125.88	125.61	125.84	125.70	125.50
7	127.10	126.31	126.92	129.00	129.92	126.40	125.96	125.84	125.66	125.78	125.66	125.58
8	126.96	126.26	126.96	129.66	130.40	126.20	125.89	125.94	125.72	125.78	125.48	125.72
9	127.05	126.17	126.93	130.76	130.56	126.10	125.95	125.88	125.70	125.72	125.63	126.14
10	127.16	126.25	126.90	131.06	130.58	126.20	125.91	125.94	125.66	125.74	125.66	126.16
11	126.78	126.24	126.88	131.26	130.04	126.08	125.84	125.93	125.64	125.75	125.68	125.90
12	126.75	126.27	126.98	131.32	130.70	125.94	125.77	125.90	125.64	125.77	125.72	125.90
13	126.82	126.25	127.08	131.04	129.85	126.00	125.78	125.92	125.62	125.88	125.90	125.82
14	126.94	126.23	127.36	130.54	129.96	126.06	125.81	125.90	125.60	125.89	125.93	125.97
15	126.88	126.28	127.67	130.08	129.72	126.16	125.80	125.86	125.66	125.84	126.25	125.96
16	126.65	126.73	128.14	129.88	129.62	126.08	125.78	125.75	125.72	125.78	126.24	125.94
17	126.78	129.16	128.24	129.66	129.24	126.05	125.80	125.83	125.70	125.77	126.00	125.94
18	126.60	129.12	128.22	129.46	128.72	125.98	125.90	125.94	125.70	125.65	125.88	125.86
19	126.58	129.10	128.13	129.54	128.56	125.89	125.94	125.98	125.70	125.64	125.85	125.76
20	126.50	128.82	128.02	129.51	128.61	125.96	126.28	126.00	125.58	125.68	125.76	125.62
21	126.42	128.61	127.86	129.28	128.18	126.04	126.18	125.98	125.57	125.70	125.79	125.78
22	126.45	128.42	127.79	129.03	128.27	126.10	126.08	125.95	125.65	125.68	125.68	125.76
23	126.78	128.06	127.82	128.85	128.45	126.02	125.94	125.90	125.68	125.64	125.73	125.62
24	126.40	127.75	128.10	129.24	128.41	125.92	125.86	125.78	125.66	125.66	125.86	125.56
25	126.32	127.60	128.56	129.84	127.90	125.88	125.80	125.80	125.64	125.56	125.90	125.49
26	126.25	127.45	128.48	129.46	127.68	125.91	125.75	125.78	125.66	125.60	126.04	125.60
27	126.36	127.24	129.15	131.80	127.40	125.81	125.92	125.76	125.56	126.30	126.36	125.64
28	126.59	127.20	129.75	132.15	127.40	125.71	126.13	125.72	125.54	126.26	126.50	125.66
29	126.26	127.04	131.10	132.46	127.13	125.58	126.14	125.71	125.96	126.30	126.38	125.68
30	126.38	....	131.50	131.87	127.02	125.64	126.12	125.62	125.98	126.35	126.31	125.62
31	126.10	....	131.46	......	127.14	....	126.16	125.65	....	126.26	....	125.60
1909.												
1	125.60	123.96	128.86	127.50	129.71	127.08	125.78	125.54	125.54	125.63	125.42	125.68
2	125.56	126.70	128.53	127.72	130.16	126.85	125.74	125.49	125.52	125.64	125.48	125.68
3	125.50	126.56	128.18	128.03	130.34	126.75	125.76	125.47	125.49	125.49	125.50	125.72
4	125.56	126.42	127.91	128.38	130.13	126.78	125.72	125.46	125.50	125.55	125.52	125.70
5	125.75	126.35	127.66	128.75	130.18	126.92	125.74	125.44	125.38	125.56	125.58	125.56
6	126.60	126.42	127.42	129.40	129.04	127.49	125.69	125.45	125.46	125.46	125.55	125.56
7	127.37	126.96	127.23	130.84	129.52	127.66	125.60	125.44	125.52	125.44	125.41	125.54
8	127.25	127.42	127.10	132.17	130.36	127.54	125.58	125.44	125.44	125.45	125.55	125.51
9	127.11	127.43	126.96	132.23	130.08	127.30	125.54	125.59	125.46	125.47	125.53	125.40
10	126.92	127.33	126.84	131.82	129.81	127.05	125.51	125.60	125.45	125.49	125.69	125.40
11	126.99	127.30	126.95	130.83	130.03	127.57	125.44	125.54	125.49	125.52	125.73	125.40
12	126.82	127.38	126.92	130.18	131.84	127.39	125.52	125.54	125.48	125.50	125.72	125.38
13	126.48	127.33	126.92	129.99	131.12	127.28	125.59	125.55	125.50	125.48	125.66	125.36
14	126.25	127.02	126.87	131.92	130.40	127.10	125.61	125.54	125.50	125.40	125.43	125.34
15	126.24	126.97	126.83	133.44	129.92	127.18	125.63	125.44	125.50	125.40	125.52	125.31
16	126.14	127.16	126.75	134.30	129.36	126.92	125.68	125.62	125.49	125.48	125.45	125.40
17	125.87	127.40	126.68	133.68	129.46	126.66	125.65	125.82	125.49	125.40	125.48	125.45
18	125.96	127.42	126.57	133.12	129.50	126.85	125.62	126.12	125.48	125.46	125.53	125.49
19	125.82	127.28	126.51	132.54	129.44	127.08	125.56	126.02	125.40	125.47	125.77	125.46
20	125.98	128.25	126.50	132.72	129.08	127.30	125.64	125.78	125.48	125.49	125.60	125.39
21	125.89	129.16	126.42	132.57	128.86	126.82	125.82	125.52	125.46	125.48	125.42	125.42
22	125.90	129.24	126.48	132.06	128.70	126.68	125.84	125.40	125.42	125.54	125.56	125.40
23	125.90	129.15	126.54	131.57	128.52	126.40	125.84	125.40	125.44	125.60	125.56	125.41
24	126.06	129.10	126.58	131.10	128.22	126.30	125.87	125.38	125.50	125.53	125.64	125.38
25	126.98	129.72	126.88	130.43	127.96	126.22	125.91	125.41	125.50	125.70	125.58	125.38
26	127.75	129.62	127.30	130.08	127.76	126.11	125.78	125.58	125.41	125.69	125.72	125.38
27	127.76	129.52	127.32	130.04	127.42	126.00	125.67	125.64	125.50	125.64	125.89	125.37
28	127.76	129.26	127.30	129.62	127.24	125.92	125.62	125.56	125.62	125.61	125.74	125.38
29	127.57	....	127.32	129.57	127.33	125.90	125.54	125.48	125.64	125.58	125.90	125.37
30	127.43	....	127.24	129.35	127.04	125.84	125.52	125.54	125.61	125.54	125.83	125.35
31	127.20	....	127.26	....	127.19	....	125.58	125.55	....	125.44	....	125.34

Daily gage height, in feet, of Hudson River at Corinth, N. Y., for 1904-1912 — Contd.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	125.35	126.31	128.89	132.68	128.28	128.82	125.98	125.64	125.54	126.58	126.42	125.92
2	125.34	126.16	130.08	132.60	128.19	128.72	125.85	125.66	125.74	126.23	126.32	125.89
3	125.36	126.14	130.64	131.96	128.08	128.30	125.64	125.59	125.84	126.10	126.32	125.74
4	125.36	126.10	130.67	131.28	128.82	127.92	125.62	125.77	125.87	125.96	126.37	125.70
5	125.34	126.01	130.40	130.48	128.86	127.64	125.60	126.14	125.96	125.88	126.60	125.65
6	125.34	126.00	129.88	130.06	128.69	128.37	125.74	126.32	126.00	125.81	126.84	125.60
7	125.34	125.95	129.94	130.23	128.32	129.28	125.64	125.99	126.20	125.94	126.98	125.59
8	125.34	125.84	129.92	130.02	128.22	129.53	125.63	125.82	126.28	126.10	126.77	125.58
9	125.34	125.88	129.74	129.72	128.10	129.42	125.60	125.68	126.26	126.00	126.55	125.63
10	125.36	125.90	129.44	128.91	128.35	129.10	125.51	125.54	126.14	126.02	126.40	125.62
11	125.35	126.03	129.13	128.51	127.77	128.81	125.56	125.78	125.98	126.06	126.34	125.56
12	125.35	126.00	128.87	128.54	127.54	128.76	125.54	126.30	125.93	126.00	126.36	125.58
13	125.35	125.88	128.58	128.24	127.20	128.69	125.59	126.38	125.85	126.01	126.28	125.52
14	125.35	125.94	128.45	127 70	127.07	128.40	125.58	126.00	125.92	125.96	126.21	125.54
15	125.35	125.94	128.15	127.65	127.07	128.15	125.56	125.88	125.84	125.90	126.15	125.57
16	125.34	125.92	127.89	127.28	126.88	127.84	125.56	125.74	125.76	125.81	126.10	125.56
17	125.36	125.92	127.65	127.15	127.72	127.68	125.55	125.92	125.70	125.84	126.02	125.50
18	125.38	125.94	127.36	126.90	126.63	127.78	125.56	125.89	125.64	125.82	125.94	125.52
19	125.41	125.88	127.26	128.70	126.68	127.83	125.58	125.87	125.66	125.84	125.85	125.57
20	125.45	125.88	127.31	129.23	126.74	127.58	125.56	125.84	125.62	125.90	125.72	125.58
21	125.60	125.92	127.46	129.20	126.81	127.28	125.54	125.77	125.62	125.89	125.66	125.60
22	126.16	126.03	127.74	128.75	127.12	127.05	125.54	125.62	125 60	125.89	125.74	125.54
23	127.28	126.12	128.16	128.64	127.09	126.80	125.55	125.70	125.60	125.90	125.94	125.52
24	127.60	126.20	128.59	128.21	127.04	126.56	125.55	125.64	125.58	126.00	125.94	125.61
25	127.58	126.17	129.56	127.94	127.64	126.39	125.54	125.62	125.58	126.07	127.92	125.72
26	127.42	126.12	131.01	128.35	129.06	126.26	125.54	125.58	125.79	126.06	125.92	125.68
27	127 18	126.12	131.16	129.08	129.28	126.20	125.52	125.57	126.11	126.18	125.86	125.68
28	127.03	127.25	131.06	128.95	129.10	126.16	125.54	125.54	126.76	126.40	125.86	125.78
29	126.85	......	131.28	128.65	128.70	126.12	125.57	125.54	127.36	126.65	125.88	125.80
30	126.58	......	131.82	128.89	128.30	126.04	125.68	125.54	126.98	126.61	125.90	125.88
31	126.46	......	132.40	....	128.56	....	125.62	125.54	....	126.53	....	125.95
1911.												
1	125.96	125.90	125.94	127.47	130.58	126.40	125.90	125.73	125.92	125.95	126.70	127.28
2	126.10	125.90	125.91	127.28	131.10	126.62	125.64	125.70	125.73	126.15	126.74	127.14
3	126.58	125.98	125.90	127.10	131.36	126.59	125.58	125.66	125.60	126.40	126.70	127.96
4	126.88	126.04	125.86	126.98	131.30	126.43	125.54	125.58	125.50	126.46	126.60	126.64
5	126.73	125.97	125.82	126.90	129.70	126.35	125.45	125.63	125.53	126.82	126.46	126.27
6	126.56	125.96	125.84	127.14	129.56	126.46	125.50	125.61	125.60	127.02	126.38	126.30
7	126.51	125.97	125.84	128.26	128.62	126.82	125.48	125.62	125.96	127.01	126.58	126.45
8	126.41	125.96	125.82	128.88	128.10	127.28	125.63	125.67	126.22	127.06	127.04	126.88
9	126.35	125.95	125.80	128.80	127.90	127.38	125.66	125.66	126.42	127.08	127.56	126.38
10	126.34	125.96	125.80	128.83	127.52	127.08	125.61	125.61	126.76	126.95	127.52	126.42
11	126.20	125.94	125.79	129.00	127.95	127.00	125.70	125.62	126.60	126.74	127.54	126.66
12	126.20	125.88	125.76	128.98	127.46	127.08	125.72	125.65	126.42	126.58	127.36	127.14
13	126.16	125.90	125.79	129.14	127.42	127.38	125.70	125.62	126.24	126.40	127.56	128.09
14	126.14	125.90	125.86	129.54	127.48	128.10	125.69	125.59	126.08	126.26	127.68	129.25
15	126.12	125.87	125.92	129.96	126.54	128.10	125.68	125.59	125.94	126.14	127.60	129.25
16	126.08	125.84	126.00	130.52	126.89	127.98	125.67	125.58	125.88	126.00	127.42	128.85
17	125.94	125.82	126.02	130.52	126.49	127.65	125.72	125.57	125.97	125.98	127.10	128.73
18	125.84	125.83	126.00	130.17	126.86	127.28	125.74	125.58	125.93	126.18	127.06	128.61
19	125.83	125.86	125.95	129.84	127.10	126.99	125.64	125.66	125.91	128.02	127.66	128.34
20	125.91	125.93	125.95	129.68	126.54	126.70	125.63	125.59	125.78	128.34	127.66	127.86
21	126.02	125.94	125.94	129.68	126.52	126.50	125.54	125.62	125.67	128.24	127.52	127.52
22	126.02	125.91	125.93	129.63	126.70	126.36	125.51	125.66	125.68	128.02	127.30	127.32
23	125.97	125.89	126.02	129.34	126.30	126.20	125.44	125.62	125.84	128.10	127.04	128.13
24	125.91	125.88	126.07	129.15	127.00	126.12	125.48	125.61	125.83	128.16	126.92	129.04
25	125.92	125.89	126.06	129.20	126.56	125.98	125.52	125.63	125.79	128.18	126.83	129.23
26	125.92	125.81	126.08	129.66	126.98	125.93	125.46	125.64	125.82	127.88	126.62	129.03
27	125.92	125.88	126.50	130.04	126.42	125.94	125.52	125.60	125.78	127.58	126.62	128.76
28	126.02	125.94	127.40	130.33	127.34	126.06	125.68	125.70	125.73	127.26	126.59	128.62
29	126.04	......	127.55	130.55	126.58	126.18	125.76	125.99	125.74	126.95	126.87	128.10
30	125.96	......	127.64	130.60	126.46	126.05	125.76	126.26	125.82	126.76	127.21	127.58
31	126.00	......	127.60	....	126.33	....	125.73	126.03	....	126.61	....	127.38

Daily gage height, in feet, of Hudson River at Corinth, N. Y., for 1904-1918 — Concluded.
[International Paper Co., observer.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	127.40	126.15	126.10	129.20	129.00	128.40	125.45	125.40	125.55	125.85	126.90	126.30
2	127.20	116.20	126.10	129.40	128.50	128.00	125.40	125.40	125.50	125.90	126.85	126.25
3	126.95	126.30	126.05	129.30	128.20	127.80	125.40	125.40	125.60	125.95	126.95	127.70
4	120.85	126.25	126.10	129.20	127.90	127.50	125.40	125.45	125.80	125.90	126.80	127.40
5	126.70	126.25	126.05	129.30	128.50	127.30	125.40	125.55	125.80	125.75	126.65	127.40
6	126.55	126.25	126.05	130.00	127.90	127.10	125.40	125.55	125.80	125.65	126.50	127.30
7	126.30	126.20	126.05	131.40	128.20	126.90	125.40	125.55	125.75	125.60	126.50	127.40
8	126.35	126.25	126.00	132.70	127.80	126.75	125.40	125.70	125.70	125.65	128.80	127.40
9	126.60	126.15	126.05	132.50	128.10	126.50	125.40	125.55	125.75	125.60	129.70	127.10
10	126.65	126.15	126.00	131.80	127.70	126.35	125.60	125.60	125.70	125.60	129.70	127.70
11	126.45	126.10	126.05	131.10	127.60	126.40	125.55	125.65	125.65	125.70	129.20	127.50
12	126.20	126.10	126.05	130.30	127.30	126.30	125.45	125.65	125.60	125.75	128.80	127.20
13	126.20	126.10	126.05	129.90	127.70	126.25	125.40	125.65	125.60	125.90	128.30	126.60
14	126.10	126.05	126.10	127.70	128.20	126.20	125.50	125.65	125.55	126.00	128.10	126.60
15	126.05	126.05	126.15	129.80	128.20	126.00	125.55	125.65	125.55	126.20	128.20	126.50
16	126.05	126.05	126.95	130.70	128.40	125.90	125.55	125.65	125.80	126.20	128.10	126.55
17	126.00	126.00	127.30	132.30	128.50	125.85	125.50	125.65	125.95	126.10	127.90	126.40
18	126.00	126.00	127.50	132.90	128.90	125.95	125.45	125.55	125.90	125.90	127.70	126.35
19	126.40	126.00	127.70	133.10	128.70	125.95	125.45	125.60	126.00	125.80	127.40	126.60
20	126.45	126.05	127.90	132.80	128.50	125.90	125.40	125.55	126.10	125.75	127.20	126.10
21	126.35	126.00	127.90	132.00	129.10	125.80	125.45	125.55	125.90	125.80	127.10	126.20
22	126.35	126.05	127.70	131.50	130.10	125.75	125.55	125.60	125.75	125.85	127.00	126.45
23	126.35	126.10	127.50	131.80	130.20	125.60	125.60	125.60	125.70	125.90	126.85	126.95
24	126.25	126.15	127.40	132.10	129.80	125.55	125.60	125.65	125.75	127.20	126.65	126.55
25	126.20	126.20	127.30	131.50	129.60	125.75	125.55	125.60	125.80	128.60	126.80	126.35
26	126.15	126.20	127.00	130.80	129.20	125.75	125.50	125.60	126.10	129.10	126.70	126.30
27	126.15	126.20	126.90	130.10	128.90	125.70	125.40	125.65	126.20	128.90	126.65	126.30
28	126.15	126.15	126.75	130.20	128.40	125.65	125.40	125.60	126.10	128.50	126.55	126.30
29	126.20	126.10	127.10	129.90	128.10	125.60	125.40	125.70	125.90	128.00	126.35	126.25
30	126.20	....	128.10	129.70	128.30	125.50	125.40	125.65	125.80	127.60	126.30	126.30
31	126.15	....	128.40	....	123.60	....	125.40	125.60	....	127.20	....	126.60

NOTE.—The construction of a dam below the point of control probably causes back water effect for the higher stages during October to December inclusive.

Daily discharge, in second-feet, of Hudson River at Corinth, N. Y., for 1904-1918.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1	....	....	....	....	....	6,900	5,540	2,140	1,730	9,410	5,620	2,190
2	....	....	....	....	....	5,170	3,610	2,140	1,890	8,880	4,660	1,850
3	....	....	....	....	....	4,280	2,740	2,140	2,260	7,270	4,310	1,910
4	....	....	....	....	....	3,610	2,480	2,140	2,760	6,300	4,170	1,620
5	....	....	....	....	....	4,450	3,010	2,140	3,010	5,390	3,870	1,970
6	....	....	....	....	....	5,170	3,460	5,170	2,760	4,520	3,270	2,050
7	....	....	....	....	....	9,900	3,010	4,450	2,710	3,740	3,420	2,210
8	....	....	....	....	....	5,360	2,610	2,870	2,460	3,120	3,240	2,100
9	....	....	....	....	....	12,900	2,250	2,030	2,230	2,930	2,930	2,100
10	....	....	....	....	....	12,900	1,970	1,830	2,280	3,120	2,710	1,890
11	....	....	....	....	....	13,100	2,140	1,830	2,120	5,140	2,760	1,850
12	....	....	....	....	....	11,900	2,030	1,730	2,190	6,700	3,120	1,720
13	....	....	....	....	....	9,670	2,740	1,550	2,050	6,460	2,710	1,890
14	....	....	....	....	....	7,930	3,150	1,550	1,970	6,380	2,740	1,850
15	....	....	....	....	....	6,500	2,610	1,640	2,480	5,140	2,510	1,810
16	....	....	....	....	....	5,730	2,480	1,550	2,580	4,380	2,580	1,770
17	....	....	....	....	....	4,990	2,250	1,550	1,990	3,900	2,410	1,730
18	....	....	....	....	....	3,930	2,250	1,550	2,410	3,740	2,340	1,770
19	....	....	....	....	....	3,300	1,930	1,550	2,660	3,010	2,410	1,770
20	....	....	....	....	....	2,740	1,930	1,210	2,410	2,930	2,050	1,730

Daily discharge, in second-feet, of Hudson River at Corinth, N. Y., for 1904-1912 — Continued.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
21	......	......	......	......	......	2,870	1,730	7,310	2,370	4,770	2,120	1,850
22	......	......	......	......	......	2,870	1,550	7,930	2,460	20,800	1,910	1,790
23	......	......	......	......	......	2,870	1,550	8,620	2,460	23,000	2,050	1,770
24	......	......	......	......	......	2,610	1,550	7,230	2,410	19,400	2,510	2,010
25	......	......	......	......	......	2,370	1,730	5,390	2,560	15,900	2,660	1,850
26	......	......	......	......	......	2,140	1,730	3,870	4,950	13,400	2,680	1,830
27	......	......	......	......	......	2,140	2,030	3,040	5,560	11,200	1,770	2,050
28	......	......	......	......	......	2,140	2,030	2,370	5,210	9,630	2,010	3,210
29	......	......	......	......	......	2,250	3,010	2,100	4,450	8,880	1,770	3,580
30	......	......	......	......	......	2,870	2,740	1,850	7,060	7,060	1,970	3,330
31	......	......	......	......	......	......	2,480	1,600	......	6,150	......	3,360
1905.												
1	3,420	2,010	1,750	37,500	11,700	3,550	9,500	9,060	2,560	3,900	3,970	5,500
2	3,640	2,100	1,810	33,800	13,000	3,330	11,800	7,810	2,460	3,840	5,650	4,840
3	3,580	2,030	1,770	28,100	9,900	2,900	17,400	6,300	5,100	3,770	5,960	7,020
4	3,300	1,910	1,790	23,700	11,600	2,680	18,500	5,140	11,700	3,710	5,920	9,090
5	2,660	1,790	1,750	23,800	10,200	2,340	15,900	4,240	18,900	3,460	5,920	8,660
6	2,050	1,870	1,750	26,800	9.500	2,610	14,500	3,270	18,900	3,150	6,070	8,270
7	2,460	1,850	1,700	26,400	8,620	3,840	11,700	3,310	17,500	2,900	6,900	8,190
8	2,930	1,890	1,700	22,800	8,360	5,990	9,760	4,000	14,700	2,930	8,100	7,270
9	3,240	1,890	1,730	19,000	8,880	10,300	7,720	3,800	12,400	2,930	7,430	6,780
10	3,150	1,850	1,730	16,600	8,270	14,300	6,940	3,460	10,000	2,740	7,520	5,840
11	3,040	1,850	1,730	16,400	8,230	9,320	5,540	2,980	8,190	2,250	6,150	4,380
12	2,930	1,850	1,700	18,700	7,350	7,890	5,500	2,760	7,720	3,580	5,170	3,640
13	2,900	1,970	1,700	19,200	7,520	8,440	4,730	2,560	8,440	8,020	5,140	4,040
14	2,870	1,830	1,700	19,200	6,940	9,230	4,210	2,540	7,110	6,860	5,170	3,770
15	2,680	1,810	1,700	18,200	5,540	7,970	3,770	2,640	5,880	5,600	4,880	2,760
16	2,660	1,810	1,660	17,100	7,930	6,340	3,640	3,840	5,170	4,910	4,660	2,410
17	2,680	1,810	1,620	14,900	6,540	5,250	3,330	6,380	4,950	4,520	4,520	2,370
18	2,610	1,810	1,660	12,600	6,660	12,600	3,710	5,540	7,520	3,970	4,170	2,370
19	2,510	1,770	1,700	10,700	5,990	13,400	4,100	4,660	12,300	3,900	3,710	2,610
20	2,510	1,850	3,120	9,060	5,690	16,300	4,070	3,390	13,200	5,170	3,210	3,270
21	2,410	1,810	3,640	9,630	5,430	18,200	3,520	3,150	16,000	6,460	2,710	3,460
22	2,410	1,890	4,000	16,500	5,990	19,700	3,040	2,580	13,900	6,150	2,710	4,000
23	2,140	1,810	3,840	17,400	4,700	17,400	2,560	2,370	11,800	5,770	2,760	5,100
24	2,030	1,810	3,770	16,800	4,450	14,500	2,460	2,190	9,760	5,140	2,870	4,590
25	1,990	1,770	4,310	15,500	3,680	11,800	2,820	2,010	7,930	4,660	2,900	3,710
26	2,050	1,770	6,070	12,900	4,310	11,600	2,640	1,890	6,620	4,240	2,950	3,580
27	1,930	1,810	9,500	12,900	4,310	14,700	2,370	1,660	5,690	3,800	2,950	3,390
28	1,890	1,770	13,400	10,700	4,380	15,400	2,320	1,660	5,140	3,520	2,870	3,180
29	1,890	......	17,800	9,850	4,450	13,800	2,210	1,550	4,660	4,480	2,930	3,360
30	2,050	......	22,300	10,400	3,520	11,300	6,150	1,640	4,310	4,170	6,150	5,100
31	2,030	......	31,600	......	3,460	......	7,520	2,230	......	3,800	......	5,770
1906.												
1	5,500	6,900	4,100	8,710	11,200	10,200	8,100	2,680	1,910	1,700	2,510	4,310
2	4,950	5,990	3,840	8,660	11,700	9,230	10,800	2,610	1,620	1,850	2,320	3,390
3	4,240	3,900	3,900	8,750	13,700	7,060	9,230	2,320	1,730	1,810	2,140	2,510
4	4,040	3,640	7,520	9,540	13,100	6,460	7,930	2,080	1,770	1,850	1,970	2,100
5	5,320	3,930	8,400	11,300	14,000	4,730	7,520	1,890	2,370	1,700	1,990	2,280
6	5,540	3,520	7,430	10,900	12,200	5 650	7,020	2,410	2,660	1,700	1,830	2,280
7	5,020	3,330	6,940	10,600	11,300	5,390	5,840	2,190	2,230	1,550	1,850	2,410
8	4,100	3,520	6,230	9,760	10,800	5,470	4,630	2,030	2,120	1,600	1,770	2,050
9	3,610	3,390	5,770	9,320	10,700	7,850	4,100	1,930	2,190	1,660	1,730	1,850
10	3,120	3,640	4,880	8,020	10,700	10,300	4,040	1,830	2,230	1,600	1,730	1,890
11	3,330	3,520	4 590	7,230	10,200	12,100	4,100	1,770	2,050	1,700	1,720	2,010
12	3,840	3,710	4,210	7,760	8,710	10,600	3,900	1,580	1,810	1,770	1,910	1,990
13	4,000	3,520	4,140	9,370	9,150	7,310	3,390	1,680	1,770	1,770	1,970	1,910
14	3,680	3,640	3,840	12,000	11,200	6,540	3,010	1,580	1,810	1,810	1,990	1,930
15	3,270	3,390	3,710	20,600	13.500	4,590	2,680	1,510	1,770	1,810	2,050	1,990
16	3,740	3,270	3,150	24,600	10,500	3,930	2 460	1,440	1,620	1,770	1,970	2,160
17	3,900	3,150	3,210	27,500	8,710	4,380	2,280	1,440	1,720	1,730	2,010	2,710
18	3,610	3,040	2,840	27,600	8,750	6,340	2,280	1,530	1,770	1,720	2,120	3,120
19	3,490	2,980	2,820	27,800	9,590	6,300	2,210	1,480	1,720	1.700	2,510	2,930
20	3,360	3,070	2,820	28,200	7,520	5,470	2,010	1,660	1,770	2,120	4,100	2,560

Daily discharge, in second-feet, of Hudson River at Corinth, N. Y., for 1904-1912 — Continued.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
21......	3,270	3,150	2,840	28,200	6,190	4,590	1,890	1,810	1,770	3,610	4,910	2,460
22......	3,870	3,710	2,870	27,700	6,460	4,380	2,080	2,050	1,700	3,740	5,540	2,660
23......	8,530	4,140	2,950	26,700	5,020	5,060	1,930	2,460	1,700	3,070	6,460	2,660
24......	16,600	4,660	2,660	23,600	6,620	5,470	2,010	2,540	1,790	2,640	5,990	2,280
25......	15,600	4,660	2,660	21,000	8,360	5,210	1,970	2,460	1,910	2,560	5,280	2,230
26......	15,300	5,060	2,510	18,600	7,760	4,730	1,890	2,230	1,770	2,980	4,660	2,190
27......	14,400	5,390	2,710	15,300	9,590	4,170	1,810	2,410	1,770	3,150	4,450	2,120
28......	12,500	4,810	4,950	13,400	14,900	3,520	2,010	2,190	1,700	3,070	5,170	2,120
29......	10,300	....	6,860	12,400	13,600	3,210	2,190	2,410	1,620	3,120	5,210	2,100
30......	8,620	....	7,520	11,300	13,800	3,390	2,440	2,340	1,620	2,930	4,560	2,010
31......	7,760	....	9,010	......	11,800	....	2,580	2,100	....	2,660	....	2,460
1907.												
1......	7,810	2,100	1,640	31,000	21,400	8,360	2,610	2,010	1,370	5,730	9,500	3,300
2......	10,200	2,080	1,620	25,600	21,100	5,550	3,270	1,990	1,410	7,680	7,930	3,330
3......	9,410	2,230	1,580	20,900	19,800	3,970	3,840	1,950	1,510	4,700	12,900	2,930
4......	10,200	2,190	1,580	17,500	20,300	3,580	3,930	1,730	2,370	3,770	15,400	2,760
5......	12,100	2,410	1,660	16,100	19,000	3,390	5,320	1,810	4,660	4,520	14,900	2,140
6......	12,900	2,510	1,620	15,800	19,500	4,280	6,820	1,850	5,250	4,730	13,400	2,370
7......	12,500	2,460	1,570	14,100	18,900	5,990	6,380	1,770	3,800	4,420	22,300	2,760
8......	12,500	2,460	1,510	13,000	16,000	5,690	2,610	1,700	2,980	5,320	25,100	2,610
9......	11,100	2,320	1,480	11,700	15,900	5,320	2,410	1,700	2,390	11,800	24,500	2,660
10......	10,300	2,250	1,440	10,500	14,400	8,190	2,160	1,700	2,320	12,100	21,300	5,060
11......	7,680	2,710	1,510	9,150	12,500	3,800	1,970	1,550	2,250	12,300	18,200	8,530
12......	8,140	2,460	1,420	8,530	11,200	3,390	2,140	1,550	3,270	9,590	15,400	15,100
13......	6,860	2,120	1,440	8,270	10,200	3,300	2,100	1,570	6,230	8,190	12,900	13,100
14......	6,150	2,100	1,490	8,360	8,880	3,100	2,050	1,600	5,540	7,270	10,800	11,400
15......	5,540	2,100	1,810	8,620	8,880	3,070	1,900	1,420	3,970	6,190	9,060	9,670
16......	4,420	2,140	2,230	8,190	7,600	3,640	1,890	1,480	3,210	5,170	7,560	9,150
17......	3,150	2,100	2,840	7,600	8,880	2,930	1,850	1,480	2,390	4,450	6,380	8,570
18......	2,980	2,030	3,420	7,110	9,850	2,460	1,850	1,420	1,970	3,900	5,770	7,600
19......	3,120	2,050	3,710	6,540	7,110	2,230	1,810	1,510	1,680	3,420	5,320	6,700
20......	3,970	1,970	3,580	6,230	6,860	2,440	1,730	2,010	1,550	3,120	4,700	6,380
21......	3,550	1,910	3,550	5,580	6,700	3,270	1,580	2,050	1,440	3,210	4,340	6,540
22......	3,330	1,790	3,900	5,250	5,690	3,390	1,490	1,970	1,360	3,270	4,630	5,470
23......	3,270	1,790	6,700	5,320	6,300	2,820	1,570	1,890	1,660	3,010	4,730	5,390
24......	2,980	1,770	10,800	9,900	6,300	2,160	2,100	1,930	2,140	2,740	4,590	11,800
25......	2,660	1,830	9,850	13,900	5,320	2,250	2,610	1,770	2,560	2,640	4,420	12,400
26......	2,760	1,770	11,000	16,300	4,340	2,280	2,820	1,720	2,710	2,560	4,240	12,300
27......	2,760	1,660	11,600	20,900	4,950	2,280	2,610	1,850	2,610	2,410	3,900	11,400
28......	2,610	1,680	17,400	20,500	6,860	2,300	2,250	1,730	2,510	6,260	3,900	11,200
29......	2,460	....	23,400	21,000	6,660	2,230	2,210	1,700	2,760	13,600	3,770	11,400
30......	2,410	....	30,500	20,800	7,810	2,320	2,190	1,480	4,170	13,000	3,580	11,700
31......	3,520	....	34,000	....	5,690	....	2,140	1,390	....	11,600	....	13,300
1908.												
1......	13,400	2,460	4,910	23,700	30,700	5,760	1,770	2,280	1,700	2,440	2,050	2,870
2......	12,500	2,320	4,590	21,700	30,800	5,800	1,720	1,990	1,580	2,410	2,010	2,560
3......	11,500	2,610	4,880	17,300	31,100	5,280	1,660	1,870	1,580	2,230	1,830	1,790
4......	10,500	2,410	5,170	16,400	26,300	4,560	1,890	2,010	1,530	1,930	1,680	1,580
5......	8,970	2,460	4,950	13,900	27,000	4,000	2,160	2,010	1,480	1,930	1,660	1,550
6......	6,260	2,930	4,730	13,100	21,100	3,740	1,950	1,970	1,460	1,890	1,620	1,270
7......	5,690	3,010	5,020	14,000	18,400	3,270	2,140	1,890	1,550	1,770	1,550	1,410
8......	5,170	2,870	5,170	17,100	20,800	2,710	1,990	2,100	1,660	1,770	1,240	1,660
9......	5,500	2,640	5,060	22,600	21,600	2,460	2,120	1,970	1,620	1,660	1,490	2,560
10......	5,920	2,840	4,950	24,100	21,700	2,710	2,030	2,100	1,550	1,700	1,550	2,610
11......	4,520	2,820	4,880	25,100	19,000	2,410	1,890	2,030	1,510	1,720	1,580	2,010
12......	4,420	2,900	5,250	25,500	22,300	2,100	1,750	2,010	1,510	1,750	1,660	2,010
13......	4,660	2,840	5,620	24,000	18,100	2,230	1,770	2,050	1,480	1,970	2,010	1,850
14......	5,100	2,930	6,700	21,500	18,600	2,410	1,830	2,010	1,440	1,990	2,080	2,160
15......	4,880	2,930	7,970	19,200	17,400	2,610	1,810	1,930	1,550	1,890	2,840	2,120
16......	4,070	4,340	10,000	18,200	16,900	2,410	1,770	1,720	1,660	1,770	2,820	2,100
17......	4,520	14,700	10,500	17,100	15,100	2,410	1,810	1,870	1,620	1,750	2,230	2,100
18......	3,900	14,500	10,400	16,200	12,700	2,190	2,010	2,100	1,620	1,530	1,070	1,930
19......	3,840	14,400	9,980	16,600	11,900	1,990	2,100	2,190	1,620	1,510	1,910	1,730
20......	3,580	13,100	9,500	16,400	12,200	2,140	2,930	2,230	1,410	1,580	1,730	1,490

Daily discharge, in second-feet, of Hudson River at Corinth, N. Y., for 1904-1912 — Continued.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.......	3,330	12,200	8,790	15,300	10,200	2,320	2,660	2,190	1,390	1,620	1,790	1,770
22.......	3,520	11,300	8,490	14,100	10,600	2,460	2,410	2,120	1,530	1,580	1,580	1,730
23.......	4,520	9,670	8,620	13,300	11,400	2,280	2,100	2,010	1,580	1,510	1,680	1,480
24.......	3,270	8,320	9,850	15,100	11,200	2,050	1,930	1,770	1,550	1,550	1,930	1,370
25.......	3,040	7,680	11,900	18,000	8,970	1,970	1,810	1,810	1,510	1,370	2,010	1,250
26.......	2,840	7,060	11,600	16,200	8,020	2,030	1,720	1,770	1,550	1,440	2,320	1,440
27.......	3,150	6,230	14,700	28,000	6,860	1,830	2,050	1,730	1,370	2,980	3,150	1,510
28.......	3,870	6.070	17,600	29,800	6,860	1,640	2,540	1,660	1,340	2,870	3,580	1,550
29.......	2,870	5,470	24,300	31,400	5,800	1,410	2,560	1,640	2,140	2,980	3,210	1,580
30.......	3,210	....	26,400	28,300	5,390	1.510	2,510	1,480	2,190	3,120	3,010	1,480
31.......	2,460	....	26,200	....	5,840	....	2,610	1,530	....	2,870	....	1,440
1909.												
1.......	1,440	5,170	13,300	7,270	17,400	5,620	1,770	1,340	1,340	1,490	1,140	1,580
2.......	1,370	4,240	11,800	8,190	19,600	4,770	1,700	1,250	1,300	1,510	1,240	1,580
3.......	1,270	3,740	10,200	9,540	20,500	4,420	1,730	1,220	1,250	1,250	1,270	1,660
4.......	1,370	3,330	9,150	11,100	19,400	4,520	1,660	1,210	1,270	1,360	1,300	1,620
5.......	1,720	3,120	7,930	12,800	19,700	5,020	1,700	1,170	1,080	1,370	1,410	1,370
6.......	3,900	3,330	6,940	15,900	18,500	7,330	1,600	1,190	1,210	1,210	1,360	1,370
7.......	6,740	5,170	6,190	23,000	16,500	7,930	1,440	1,170	1,300	1,170	1,130	1,340
8.......	6,260	6,940	5,390	29,900	20,600	7,430	1,410	1,170	1,170	1,190	1,360	1,290
9.......	5,730	6,980	5,170	30,500	19,200	6,460	1,340	1,420	1,210	1,220	1,410	1,110
10.......	5,020	6,580	4,730	28,100	17,900	5,500	1,290	1,440	1,190	1,250	1,600	1,110
11.......	5,280	6,460	5,140	22,900	19,000	7,560	1,170	1,340	1,250	1,300	1,680	1,110
12.......	4,660	6,780	5,020	19,700	28,200	6,820	1,300	1,340	1,240	1,270	1,660	1,080
13.	3,520	6,580	5,020	18,800	24,400	6,380	1,420	1,360	1,270	1 240	1,550	1,050
14.......	2,840	5,390	4,840	28,600	20,800	5,690	1,460	1 340	1,270	1,110	1,160	1,030
15.......	2,820	5,210	4,700	36,700	18,400	5,880	1,490	1 170	1,270	1,110	1,300	984
16.......	2,560	5,920	4,420	41,40)	15,700	5,020	1,580	1 480	1,250	1,240	1,190	1,110
17.......	1,950	6,860	4,170	38,000	16,200	4,100	1,530	1,850	1,250	1,110	1,240	1,190
18.......	2,140	6,940	3,800	34,900	16,400	4,770	1,480	2,510	1,240	1,210	1,320	1,250
19.......	1,850	6,380	3,610	31,800	16,100	5,620	1,370	2,280	1,110	1,220	1,750	1,210
20.......	1,970	10,500	3,580	32,800	14,400	6,460	1,510	1,770	1,240	1,250	1,440	1,100
21.......	1,990	14,700	3,330	32,000	13,300	4,660	1,850	1,300	1,210	1,240	1,140	1,140
22.......	2,010	15,100	3,520	29,300	12,600	4,170	1,890	1,110	1,140	1,340	1,370	1,110
23.......	2,010	14,700	3,710	26,700	11,800	3,270	1,890	1,110	1,170	1,440	1,370	1,130
24.......	2,370	14,400	3,840	24,300	10,400	2,980	1,950	1,080	1,270	1,320	1,510	1,080
25.......	5,250	17,400	4,880	20,900	9,230	2,760	2,030	1,130	1,270	1,620	1,410	1,080
26.......	8,320	16,900	6,460	19,200	8,360	2,480	1,770	1,410	1,130	1,600	1,660	1,080
27.......	8,360	16,500	6,540	19,000	6,940	2,230	1,570	1,510	1,270	1,510	1,990	1,070
28.......	8,360	15,200	6,460	16,900	6,230	2,050	1,480	1,370	1,480	1,460	1,700	1,080
29.......	7,560	....	6,540	16,700	6,580	2,010	1,340	1,240	1,510	1,410	2,010	1,070
30.......	6,980	....	6,230	15,600	9,150	1,890	1,300	1,340	1,460	1,340	1,870	1,040
31.......	6,070	....	6,300	....	6,030	....	1,410	1,360	....	1,170	....	1,030
1910.												
1.......	1,040	3,010	13,500	32,600	10,700	13,100	2,190	1,510	1,340	3,840	3,330	2,050
2.......	1,030	2,610	19,200	32,200	10,300	12,700	1,910	1,550	1,700	2,790	3,040	1,930
3.......	1,050	2,560	22,000	28,800	9,760	10,800	1,510	1,420	1,890	2,460	3,040	1,700
4.......	1,050	2,460	22,100	25,200	13,100	9,060	1,480	1,750	1,950	2,140	3,180	1,620
5.......	1,030	2,250	20,800	21,200	13,300	7,850	1,550	2,560	2,140	1,970	3,900	1,530
6.......	1,030	2,230	18,200	19,000	12,500	11,100	1,700	3,040	2,230	1,830	4,730	1,440
7.......	1,030	2,120	18,500	19,900	10,800	15,300	1,510	2,210	2,710	2,100	5,250	1,420
8.......	1,030	1,890	18,400	18,900	10,400	16,500	1,490	1,850	2,930	2,460	4,280	1,410
9.......	1,030	1,970	17,500	17,400	9,850	16,000	1,440	1,580	2,870	2,230	3,740	1,490
10.......	1,050	2,010	16,100	13,600	11,000	14,400	1,340	1,340	2,560	2,280	3,270	1,480
11.......	1,040	2,300	14,600	11,700	8,400	13,100	1,370	1,770	2,190	2,370	3,100	1,370
12.......	1,040	2,230	13,400	11,800	7,430	12,900	1,340	2,980	2,080	2,230	3,150	1,410
13.......	1,040	1,970	12,000	10,500	6,070	12,500	1,420	3,210	1,910	2,250	2,930	1,300
14.......	1,040	2,100	11,400	8,100	5,580	11,200	1,410	2.230	2,050	2,140	2,740	1,340
15.......	1,040	2,100	10,100	7,890	5,580	10,100	1,370	1,970	1,890	2,010	2,580	1,390
16.......	1,030	2,050	8,930	6,380	4,880	8,710	1,370	1,700	1,740	1,830	2,460	1,370
17.......	1,050	2,050	7,890	5,880	4,310	8,020	1,360	2,050	1,620	1,890	2,280	1,270
18.......	1,080	2,100	6,700	4,950	4,000	8,440	1,370	1,990	1,510	1,850	2,100	1,300
19.......	1,130	1,970	6,300	12,600	4,170	8,660	1,410	1,950	1,550	1,890	1,910	1,390
20.......	1,240	1,970	6,500	15,100	4,380	7,600	1,370	1,890	1,480	2,010	1,660	1,410

Daily discharge, in second-feet, of Hudson River at Corinth, N. Y., for 1904–1912 — Continued.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.......	1,440	2,050	7,110	14,900	4,630	6,380	1,340	1,750	1,480	1,990	1,550	1,440
22.......	2,610	2,300	8,270	12,800	5,770	5,500	1,340	1,480	1,440	1,990	1,700	1,340
23.......	6,380	2,510	10,100	12,300	5,650	4,590	1,360	1,620	1,440	2,010	2,100	1,300
24.......	7,680	2,710	12,100	10,300	5,470	3,770	1,360	1,510	1,410	2,230	2,100	1,460
25.......	7,600	2,640	16,700	9,150	7,850	3,240	1,340	1,480	1,410	2,390	2,050	1,660
26.......	6,940	2,510	23,900	11,000	14,300	2,870	1,340	1,410	1,790	2,370	2,050	1,580
27.......	5,990	2,510	24,600	14,400	15,300	2,710	1,300	1,390	2,480	2,660	1,930	1,580
28.......	5,430	6,260	24,100	13,700	14,400	2,610	1,340	1,340	4,450	3,270	1,930	1,770
29.......	4,770	....	25,200	12,400	12,600	2,510	1,390	1,340	6,700	4,070	1,970	1,810
30.......	3,840	....	28,100	13,500	10,800	2,320	1,580	1,340	5,250	3,930	2,010	1,970
31.......	3,460	....	31,100	....	11,900	....	1,480	1,340	....	3,680	....	2,120
1911.												
1.......	2,190	2,010	2,100	7,150	21,700	3,270	2,010	1,680	2,050	2,120	4,240	6,380
2.......	2,460	2,010	2,030	6,380	24,300	3,970	1,510	1,620	1,680	2,580	4,380	5,840
3.......	3,840	2,190	2,010	5,690	25,700	3,870	1,410	1,550	1,440	3,270	4,240	9,230
4.......	4,880	2,320	1,930	5,250	25,400	3.360	1,340	1,410	1,270	3,460	3,900	4.040
5.......	4,340	2,160	1,850	4,950	17,300	3,120	1,190	1,490	1,320	4,660	3,460	2,900
6.......	3,770	2,190	1,890	5,840	16,700	3,460	1,270	1,460	1,440	5,390	3,210	2,980
7.......	3,610	2,160	1,890	10,600	12,200	4,660	1.240	1,480	2,140	5,360	3,840	3,420
8.......	3,300	2,140	1,850	13,400	9,850	6,380	1,490	1,570	2,760	5,540	5,470	3,210
9.......	3,210	2,120	1,810	13,000	8,970	6,780	1,550	1,550	3,330	5,620	7,520	3,210
10.......	3,100	2,140	1,810	13,200	7,350	5,610	1,460	1,460	4,450	5,140	7,350	3,330
11.......	2,710	2,100	1,790	14,000	9,190	5,320	1,620	1,480	3,900	4,380	7,430	4,100
12.......	2,710	1,970	1,730	13,900	7,110	5,610	1,660	1,530	3,330	3,840	6,700	5,840
13......	2,610	2,010	1,790	14,600	6,940	6,780	1,620	1,480	2,820	3,270	7,520	9,810
14......	2,560	2,010	1,930	16,600	7,190	9,850	1,600	1,420	2,410	2,870	8,020	15,200
15......	2,510	1,950	2,050	18,600	3,710	9,850	1,580	1,420	2,100	2,560	7,680	15,200
16......	2,410	1,890	2,230	21,400	4,910	9,320	1,570	1,410	1,970	2,230	6,940	13,300
17.......	2,100	1,850	2,280	21,400	3,550	7,890	1,660	1,390	2,160	2,190	5,690	12,700
18......	1,890	1,870	2,230	19,600	4,810	6,380	1,700	1,410	2,080	2,660	5,540	12,200
19......	1,870	1,930	2,120	18,000	5,690	5,280	1,510	1,550	2,030	9,500	7,930	10,900
20......	2,030	2,080	2,120	17,200	3,710	4,240	1,490	1,420	1,770	10,900	7,930	8,790
21......	2,280	2,100	2,100	17,200	3,640	3,580	1,340	1,480	1,570	10,500	7,350	7,350
22.......	2,280	2,030	2,080	17,000	4,240	3,150	1,290	1,550	1,580	9,500	6,460	6,540
23.......	2,160	1,990	2,280	15,600	2,980	2,710	1,170	1,480	1,890	9,850	5,470	9,960
24.......	2,030	1,970	2,390	14,700	5,320	2,510	1,240	1,460	1,870	10,100	5,020	14,200
25.......	2,050	1,990	2,370	14,900	3,770	2,190	1,300	1,490	1,790	10,200	4,700	15,100
26.......	2,050	1,830	2,410	17,100	5,250	2,080	1,210	1,510	1,850	8,880	3,970	14,100
27.......	2,050	1,970	3,580	19,000	3,330	2,100	1,300	1,440	1,770	7,600	3,970	12,900
28.......	2,280	2,100	6,860	20,400	6,620	2,370	1,580	1,620	1,680	6,300	3,870	12,200
29.......	2,320	....	7,480	21,500	3,840	2,660	1,730	2,210	1,700	5,110	4,840	9,850
30.......	2,140	....	7,850	21,800	3,460	2,340	1,730	2,870	1,850	4,450	6,110	7,600
31.......	2,230	....	7,680	....	3,070	......	1,680	2,410	....	3,930	....	6,780
1912.												
1.......	6,860	2,580	2,460	14,900	14,000	11,200	1,190	1,110	1,360	1,910	4,950	2,710
2.......	6,070	2,710	2,460	15,900	13,000	9,410	1,110	1,110	1,270	2,010	4,770	2,840
3.......	5,140	2,980	2,340	15,400	10,300	8,530	1,110	1,110	1,440	2,120	5,140	8,100
4.......	4,770	2,840	2,460	14,900	8,970	7,270	1,110	1,190	1,810	2,010	4,590	6,860
5.......	4,240	2,840	2,340	15,400	11,700	6,460	1,110	1,360	1,810	1,720	4,070	6,860
6.......	3,740	2,840	2,340	18,800	8,970	5,690	1,110	1,360	1,810	1,530	3,580	6,460
7.......	2,980	2,710	2,340	25,900	10,300	4,950	1,110	1,360	1,720	1,440	3,580	6,860
8.......	3,120	2,840	2,230	32,700	8,530	4,420	1,110	1,620	1,620	1,530	13,000	6,860
9.......	3,900	2,580	2,340	31,600	9,850	3,580	1,110	1,360	1,720	1,440	18,300	5,690
10.......	4,170	2,580	2.230	23,000	8,100	3,120	1,440	1,440	1,620	1,440	18,300	8,100
11.......	3,420	2,460	2,340	24,300	7,680	3,270	1,360	1,530	1,530	1,620	14,900	7,270
12.......	2,710	2,460	2,340	20,300	6,460	2,980	1,190	1,530	1,440	1,720	13,000	6,070
13.......	2,710	2,460	2,340	18,300	8,100	2,840	1,110	1,530	1,440	2,010	10,800	3,900
14.......	2,460	2,340	2,460	17,300	10,300	2,710	1,270	1,530	1,360	2,230	9,850	3,900
15.......	2,340	2,340	2,580	17,800	10,300	2,230	1,360	1,530	1,360	2,710	10,300	3,580
16.......	2,340	2,340	5,140	22,300	11,200	2,010	1,360	1,530	1,810	2,710	9,850	3,740
17.......	2,230	2,230	6,460	30,600	11,700	1,910	1,270	1,530	2,120	2,460	8,970	3,270
18.......	2,230	2,230	7,270	33,800	13,500	2,120	1,190	1,360	2,010	2,010	8,100	3,120
19.......	3,270	2,230	8,100	34,800	12,600	2,120	1,190	1,440	2,230	1,810	6,860	3,900
20.......	3,420	2,340	8,970	33,200	11,700	2,010	1,110	1,360	2,460	1,720	6,070	2,460

Daily discharge, in second feet, of Hudson River at Corinth, N. Y., for 1904–1912 — Concluded.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.......	3,120	2,230	8,970	29,000	14,400	1,810	1,190	1,360	2,010	1,810	5,690	2,710
22.......	3,120	2,340	8,100	26,400	19,300	1,720	1,360	1,440	1,720	1,910	5,320	3,420
23.......	3,120	2,460	7,270	28,000	19,800	1,440	1,440	1,440	1,620	2,010	4,770	5,140
24.......	2,840	2,580	6,860	29,500	17,800	1,360	1,440	1,530	1,720	6,070	4,070	3,740
25.......	2,710	2,710	6,460	26,400	17,800	1,720	1,360	1,440	1,810	12,100	4,590	3,120
26.......	2,580	2,710	5,320	22,800	14,900	1,720	1,270	1,440	2,460	14,000	4,240	2,980
27.......	2,580	2,710	4,950	19,300	13,500	1,620	1,110	1,530	2,710	13,500	4,070	2,980
28.......	2,580	2,580	4,420	19,800	11,200	1,530	1,110	1,440	2,460	11,700	3,740	2,980
29.......	2,710	2,460	5,690	18,300	9,850	1,440	1,110	1,620	2,010	9,410	3,120	2,840
30.......	2,710	....	9,850	17,300	10,800	1,270	1,110	1,530	1,810	7,680	2,980	2,980
31.......	2,580	....	11,200	....	12,100	....	1,110	1,440	....	6,070	....	3,900

Monthly discharge of Hudson River at Corinth, N. Y., for 1904–1912.
[Drainage area, 2,730 square miles.a]

MONTH.	Discharge in Second-Feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1904.						
June............................	13,100	2,140	5,520	2.02	2.25	B.
July............................	5,540	1,550	2,460	.901	1.04	B.
August..........................	8,620	1,210	3,030	1.11	1.28	B.
September.......................	7,060	1,730	2,890	1.06	1.18	B.
October.........................	23,000	1,930	7,830	2.87	3.31	C.
November........................	5,620	1,770	2,840	1.04	1.16	C.
December........................	3,580	1,620	2,080	.762	.88	C.
1905.						
January.........................	3,640	1,890	2,600	.952	1.10	B.
February........................	2,100	1,770	1,860	.681	.71	B.
March...........................	31,600	1,620	5,030	1.84	2.12	B.
April...........................	37,500	9,060	18,200	6.67	7.44	B.
May.............................	13,000	3,460	6,970	2.55	2.94	B.
June............................	19,700	2,340	9,900	3.63	4.05	D.
July............................	18,500	2,210	6,580	2.41	2.78	D.
August..........................	9,060	1,550	3,570	1.31	1.51	C.
September.......................	18,900	2,460	9,350	3.42	3.82	B.
October.........................	8,020	2,250	4,340	1.59	1.83	A.
November........................	8,100	2,710	4,730	1.73	1.93	A.
December........................	9,190	2,370	4,790	1.75	2.02	C.
The year....................	37,500	1,550	6,490	2.38	32.25	
1906.						
January.........................	16,600	3,120	6,400	2.34	2.70	B.
February........................	6,900	2,980	3,950	1.45	1.51	B.
March...........................	9,010	2,510	4,580	1.68	1.94	B.
April...........................	28,200	7,230	16,200	5.93	6.62	B.
May.............................	14,900	5,020	10,400	3.81	4.39	B.
June............................	12,100	3,210	6,120	2.24	2.50	B.
July............................	10,800	1,810	3,880	1.42	1.64	B.
August..........................	2,680	1,440	2,020	.740	.85	B.
September.......................	2,660	1,620	1,870	.685	.76	B.
October.........................	3,740	1,550	2,210	.810	.93	B.
November........................	6,460	1,720	3,150	1.15	1.28	B.
December........................	4,310	1,850	2,380	.872	1.01	B.
The year....................	28,200	1,440	5,250	1.92	26.13	

a See Drainage Area Page 324.

Monthly discharge of Hudson River at Corinth, N. Y., for 1904–1912 — **Continued.**

MONTH.	Discharge in Second-Feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1907.						
January	12,900	2,410	6,240	2.29	2.64	B.
February	2,710	1,660	2,110	.773	.80	B.
March	34,000	1,420	6,510	2.38	2.74	B.
April	31,000	5,250	13,100	4.80	5.36	B.
May	21,400	4,340	11,100	4.07	4.69	B.
June	8,360	2,160	3,670	1.34	1.50	B.
July	6,820	1,490	2,650	.971	1.12	B.
August	2,050	1,390	1,720	.630	.73	B.
September	6,230	1,360	2,800	1.03	1.15	B.
October	13,600	2,410	6,220	2.28	2.63	B.
November	25,100	3,580	10,200	3.74	4.17	B.
December	15,100	2,140	7,710	2.82	3.25	B.
The year	34,000	1,360	6,190	2.27	30.78	
1908.						
January	13,400	2,460	5,320	1.95	2.25	B.
February	14,700	2,320	6,070	2.22	2.39	B.
March	26,400	4,590	9,630	3.53	4.07	B.
April	31,400	13,100	19,800	7.25	8.09	B.
May	31,100	5,390	16,300	5.97	6.88	B.
June	5,800	1,410	2,760	1.01	1.13	C.
July	2,930	1,660	2,060	.755	.87	C.
August	2,280	1,480	1,940	.711	.82	D.
September	2,190	1,340	1,580	.579	.65	D.
October	3,120	1,370	1,970	.722	.83	D.
November	3,580	1,240	2,060	.755	.84	D.
December	2,870	1,250	1,810	.663	.76	D.
The year	31,400	1,240	5,930	2.17	29.58	
1909.						
January	8,360	1,270	3,990	1.46	1.68	B.
February	17,400	3,120	8,590	3.15	3.28	B.
March	13,300	3,330	5,910	2.16	2.49	B.
April	41,400	7,270	23,400	8.57	9.56	A.
May	28,200	6,030	15,500	5.68	6.55	A.
June	7,930	1,890	4,860	1.78	1.99	A.
July	2,030	1,170	1,560	.571	.66	A.
August	2,510	1,080	1,390	.509	.59	A.
September	1,510	1,080	1,250	.458	.51	B.
October	1,620	1,110	1,310	.480	.55	B.
November	2,010	1,130	1,450	.531	.59	B.
December	1,660	984	1,200	.440	.51	B.
The year	41,400	984	5,820	2.13	28.74	
1910.						
January	7,680	1,030	2,490	0.912	1.05	B.
February	6,260	1,890	2,410	.883	.92	B.
March	31,100	6,300	16,000	5.86	6.76	A.
April	32,600	4,950	14,900	5.46	6.09	A.
May	15,300	4,000	8,880	3.25	3.75	B.
June	16,500	2,320	8,820	3.23	3.60	B.
July	2,190	1,300	1,450	.531	.61	C.
August	3,210	1,340	1,820	.667	.77	A.
September	6,700	1,340	2,270	.832	.93	B.
October	4,070	1,830	2,420	.886	1.02	C.
November	5,250	1,550	2,740	1.00	1.12	A.
December	2,120	1,270	1,540	.564	.65	A.
The year	32,600	1,030	5,490	2.01	27.27	

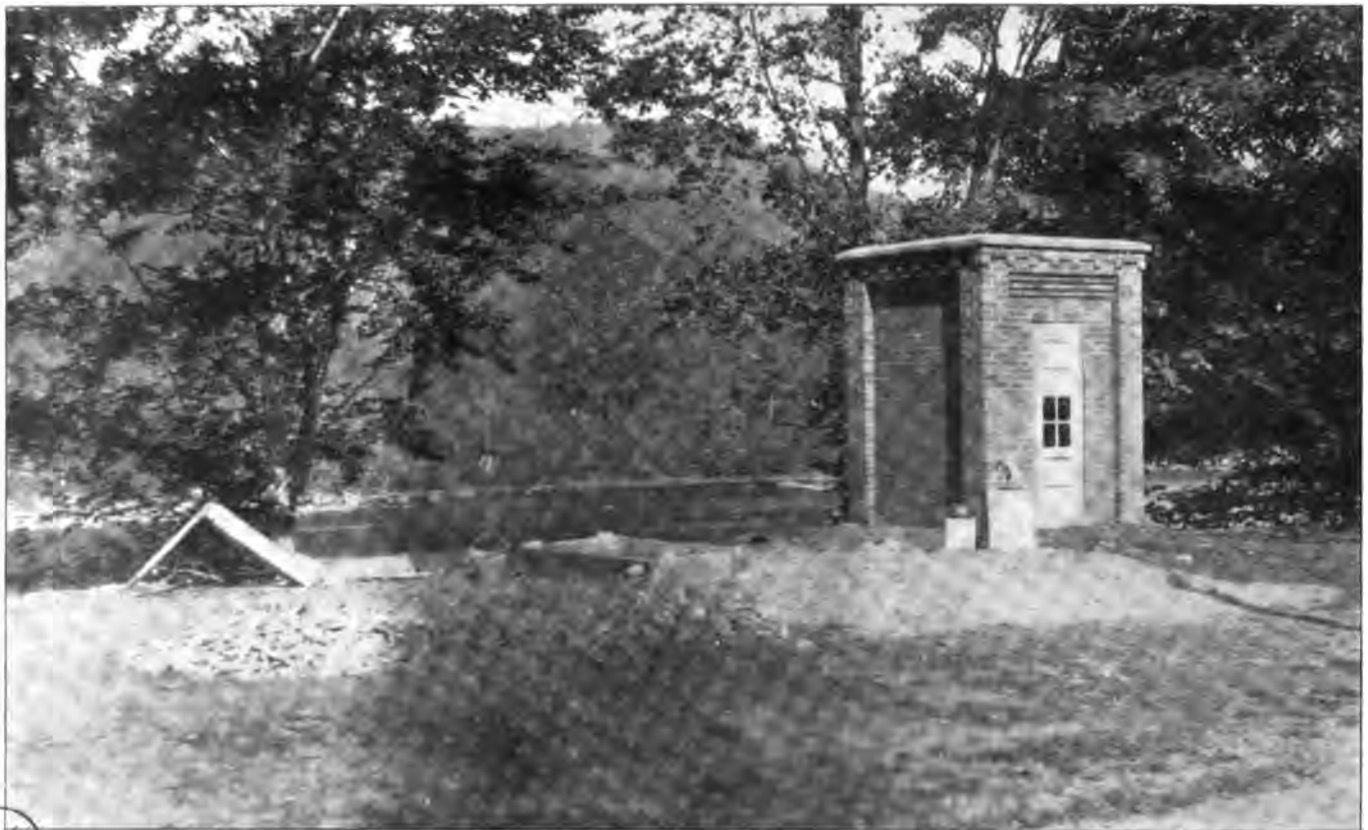

Fig. D.

HUDSON RIVER AT SPIER FALLS, N. Y.
Brick shelter for automatic gage.

HUDSON RIVER AT SPIER FALLS. Fig. E.
Cable support and gaging car.

Monthly discharge of Hudson River at Corinth, N. Y., for 1904-1912 — Concluded.

MONTH.	Discharge in Second-Feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1911.						
January	4,880	1,870	2,640	0.967	1.11	B.
February	2,320	1,830	2,040	.747	.78	B.
March	7,850	1,730	2,790	1.02	1.18	B.
April	21,800	4,950	14,700	5.38	6.00	B.
May	25,700	2,980	8,770	3.21	3.70	B.
June	9,850	2,080	4,690	1.72	1.92	D.
July	2,010	1,170	1,490	.546	.63	D.
August	2,870	1,390	1,590	.582	.67	D.
September	4,450	1,270	2,130	.780	.87	D.
October	10,900	2,120	5,610	2.05	2.36	D.
November	8,020	3,210	5,690	2.08	2.31	D.
December	15,200	2,900	8,680	3.18	3.67	D.
The year	25,700	1,170	5,060	1.85	25.20	
[Drainage area, 2,760 square miles.]						
1912.						
January	6,860	2,230	3,320	1.21	1.40	C.
February	2,980	2,230	2,540	.921	.99	C.
March	11,200	2,230	4,860	1.76	2.03	C.
April	34,800	14,900	23,400	8.48	9.46	C.
May	19,800	6,460	11,900	4.31	4.97	C.
June	11,200	1,270	3,480	1.26	1.41	C.
July	1,440	1,110	1,210	.438	.50	C.
August	1,620	1,110	1,420	.511	.59	C.
September	2,710	1,270	1,810	.656	.73	C.
October	14,000	1,440	4,010	1.45	1.67	C.
November	18,300	2,980	7,390	2.68	2.99	C.
December	8,100	2,460	4,490	1.63	1.88	C.
The year	34,800	1,110	5,820	2.11	28.62	

Hudson River at Spier Falls, N. Y.

Location.— On the river road, one-half mile below the Spier Falls dam, about 11½ miles below the mouth of Sacandaga river. This station is most easily accessible from Glens Falls, N. Y.; distance, 11 miles.

Records available.— October 7 to December 31, 1912.

Drainage area.— 2,800 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Recording hydrograph (Gurley Simplex type) and auxiliary sloping staff gage. The automatic gage is in a brick shelter 5 feet square inside dimensions. (See Fig. D.) Underneath the shelter is a brick well 3½ feet square and 21 feet deep. This well is connected with the river by a 4-inch cast iron water pipe 78 feet long. A shear gate valve is set at the inner end of the pipe for use in cleaning the well when necessary. The outer end is fastened firmly in a concrete anchorage and is submerged at all stages. Inside the well is a hook gage used for setting the automatic gage. The sloping staff gage is mounted on small concrete piers ten feet upstream from the shelter.

Channel.— Coarse gravel and boulders.

Discharge measurements.— Made from a cable and car, located about 1,000 feet downstream from the automatic gage. The cable is of 450 feet span,

supported on the left bank by a pulley hung from a frame about 4 feet high, on the right bank by a pulley hung from a frame about 20 feet high. (See Fig. E.)

Winter flow.— Ice condition prevails during extreme cold weather. It is not known how much this will affect the relation between gage height and discharge. Efforts will be made to obtain frequent discharge measurements.

Artificial control.— Control at the Spier Falls dam is indicated by the hydrograph.

Accuracy.— Very consistent meter measurements have been made covering the range of gage heights for 1912 and the record is excellent.

Co-operation.— Station established and maintained in co-operation with the United States Geological Survey, the Adirondack Electric Power Corporation, the International Paper Company, the Union Bag and Paper Company and the Finch, Pruyn Paper Company.

Discharge measurements of Hudson River at Spier Falls, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
1912.		*Feet.*	*Second-Feet.*
Sept. 15 *a*	C. C. Covert	0.06	5.72
Oct. 31	C. S. De Golyer	4.85	5,320
31	C. S. De Golyer	4.86	5,330
Nov. 1	C. S. De Golyer	4.73	5,030
1	C. S. De Golyer	4.50	4,360
2	C. S. De Golyer	4.58	4,660
15	J. G. Mathers	5.95	8,400
15	J. G. Mathers	6.01	8,710
29	J. G. Mathers	3.97	3,370
30	J. G. Mathers	3.90	3,150

a Made by wading in tail race of power plant. Plant shut down.

Daily gage height, in feet, of Hudson River at Spier Falls, N. Y., for 1912.

[Geo. C. Fifield, observer.]

DAY.	Oct.	Nov.	Dec.	DAY.	Oct.	Nov.	Dec.
1	......	4.41	3.61	17	3.43	5.59	3.91
2	......	4.39	3.75	18	3.35	5.35	3.82
3	......	4.47	5.27	19	3.33	5.06	4.15
4	......	4.33	6.15	20	1.75	4.84	4.71
5	......	4.17	6.16	21	3.17	4.76	4.86
6	......	4.04	6.03	22	2.76	4.47	4.62
7	3.35	4.18	6.09	23	2.71	4.46	4.39
8	2.71	6.55	6.11	24	4.43	4.26	4.14
9	2.89	7.47	5.82	25	6.27	4.37	3.81
10	2.56	7.56	5.30	26	6.71	4.34	3.82
11	2.75	7.13	5.15	27	6.49	4.14	3.72
12	3.03	6.57	4.85	28	6.10	4.06	3.74
13	3.14	6.07	4.23	29	5.64	3.91	3.52
14	3.49	5.84	4.07	30	5.14	3.75	3.72
15	3.47	5.90	4.04	31	4.71	......	4.10
16	3.59	5.85	4.09				

NOTE.— Mean daily gage height obtained by averaging hourly readings for each 24 hour period.

Daily discharge, in second-feet, of Hudson River at Spier Falls, N. Y., for 1912.

DAY.	Oct.	Nov.	Dec.	DAY.	Oct.	Nov.	Dec.
1	......	4,280	2,710	17	2,420	7,380	3,230
2	......	4,240	2,940	18	2,310	6,680	3,070
3	......	4,420	6,450	19	2,280	5,870	3,700
4	......	4,100	9,090	20	700	5,300	4,980
5	......	3,750	9,120	21	2,060	5,100	5,350
6	......	3,480	8,710	22	1,570	4,420	4,770
7	2,310	3,770	8,900	23	1,510	4,400	4,240
8	1,510	10,400	8,960	24	4,330	3,940	3,680
9	1,720	13,500	8,070	25	9,470	4,190	3,050
10	1,360	13,800	6,530	26	10,900	4,120	3,070
11	1,560	12,300	6,120	27	10,200	3,680	2,890
12	1,890	10,400	5,320	28	8,930	3,520	2,930
13	2,020	8,840	3,880	29	7,530	3,230	2,560
14	2,420	8,130	3,540	30	6,090	2,940	2,890
15	2,480	8,310	3,480	31	4,980	......	3,600
16	2,670	8,160	3,580				

NOTE.— Daily discharge determined from a well defined rating curve. Daily discharge considered to be accurate within 5 per cent.

Monthly discharge of Hudson River at Spier Falls, N. Y., for 1912.
[Drainage area, 2,800 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October 7-31	10,900	700	3,810	1.36	1.26	A.
November	13,800	2,940	6,220	2.22	2.48	A.
December	9,120	2,560	4,880	1.74	2 01	A.

Hudson River at Mechanicville, N. Y.

Location.— At the Duncan dam of the West Virginia Pulp and Paper Company in the village of Mechanicville about 3,700 feet above the mouth of Anthony Kill (coming in from the right), 1¼ miles below the mouth of Hoosic river (coming in from the left) and about 19 miles above the mouth of Mohawk river which enters from the right at Cohoes.

Records available.— 1888 to 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 4,500 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Recording gage installed at the dam in the summer of 1910 for the purpose of obtaining a more accurate register of the daily flow over the crest of the dam; previous to 1910 two gage readings daily on the crest of the dam.

Discharge measurements.— Determinations of discharge for periods previous to the summer of 1910 computed by using two daily gage readings on the crest of the dam and continuous record of the run of the wheels in the adjoining paper mill. In 1904 the dam was raised and a concrete crest and

apron were added, so that it now has a rounded or ogee section. A discharge curve has been calculated by means of co-efficients derived from the United States Geological Survey experiments on dams of ogee section.

***Accuracy.*— Records at this station are very carefully made and may be considered good for this type of station.**

***Co-operation.*— Records are computed and furnished by Mr. R. P. Bloss, engineer of the West Virginia Pulp and Paper Company.**

The records which have been kept at this station are among the longest in the State. They have been used as basic data in all studies of storage problems on the upper Hudson. In using these records it should be remembered that water is diverted past this station in the Champlain canal.

Daily discharge, in second-feet, of Hudson River at Mechanicville, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	9,078	4,205	3,308	21,856	16,338	14,992	2,463	1,168	a997	3,074	9,357	a2,861
2	8,404	4,205	3,706	22,571	15,408	a13,171	1,665	1,102	1,428	2,948	8,519	7,315
3	7,579	3,901	a5,157	22,564	13,230	15,567	1,177	1,144	1,178	2,307	a6,889	8,285
4	6,186	a1,268	2,250	20,260	12,384	11,344	760	a960	1,239	9,452	9,284	10,327
5	5,927	3,039	3,483	19,403	a9,312	9,652	931	1,124	1,092	3,141	6,909	10,911
6	4,177	3,450	3,080	24,396	12,876	6,962	1,557	978	1,754	a1,536	7,221	11,033
7	a3,880	3,990	2,318	a30,250	10,983	8,479	a1,016	1,420	1,414	2,474	7,445	11,434
8	5,390	3,351	2,323	47,275	12,243	7,544	1,825	925	a	2,369	21,688	a8,247
9	4,771	3,397	3,905	41,415	9,773	a6,289	1,359	1,082	2,040	1,801	20,173	11,111
10	4,362	3,166	a6,327	35.752	11,424	6,339	1,412	1,398	2,355	3,818	a17,685	11,556
11	4,921	a3,929	3,742	30,701	8,674	5,141	1,695	a834	1,589	1,667	17,625	11,405
12	4,971	2,138	3,783	25,713	a9,354	4,908	1,440	1,337	1,599	2,533	15,374	11,183
13	4,072	3,655	15,944	22,559	9,121	4,753	1,369	2,030	1,216	a2,630	13,268	9,052
14	a5,178	3,357	10,493	a21,900	9,459	4,586	a687	1,431	1,296	2,843	10,776	8,873
15	3,978	2,626	9,334	21,780	11,178	4 026	827	1 399	a849	3,490	10 968	a6 073
16	3 590	2,542	28,889	24,020	10,538	a3,189	2.173	1,411	3,208	3,078	13,683	8,472
17	3,965	2,500	a17,200	31,082	11,956	4,445	1,350	1,407	4,329	3,233	a12,627	6,894
18	2,513	a600	16,991	34,767	12,586	3,383	1,265	a677	3,503	....	12,627	6,164
19	3,243	1,491	16,608	37,401	a12,482	3,212	1,305	1,381	3,784	3,078	9,931	7,254
20	4 069	3,306	12,455	36,943	12,612	4,077	1,723	1,961	3,986	a748	9,254	8,057
21	a5,725	4,606	15,325	a31,820	12,596	3,425	a1,005	1,403	4,289	2,831	9,296	9,398
22	5 975	3,534	12,804	28,581	17,343	2,707	1,209	1,323	a3,455	3,066	9,009	a8,367
23	4,445	2,786	11,067	25,246	19,915	a2 729	1,154	1 188	4,266	3,230	8,378	9,685
24	4,116	4,378	a9,584	31,340	18,484	2,442	1,136	1,607	3,726	27,618	a6,617	11,215
25	3,955	a4,400	10,564	29,936	17,325	3,270	1,180	a810	3,443	19,496	9,771	6,942
26	3,931	4,842	8,222	26,071	a15,576	2,152	1,188	1,285	2,416	32,235	9,067	7,366
27	3,297	5,420	7,370	21,825	14,645	1,734	1,173	1,636	2,515	a25,599	9,696	6,453
28	a5,264	4,412	7,445	a20,800	11,974	1,729	a906	1,211	3,453	15,089	7,107	5,362
29	3,447	4,019	16,532	20,683	9,852	1.612	1,291	1,172	a3,026	12,402	6,704	a7,132
30	4,228	....	22,017	20,044	14,475	a2,300	1,172	1,291	4,190	10,646	6,341	9,132
31	2,808	....	a17,690	....	14,484	....	1,091	1,372	....	10,184	....	10,347

a Sunday.

Monthly discharge of Hudson River at Mechanicville, N. Y., for 1912.
[Drainage area, 4,500 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	9,078	2,513	4,760	1.06	1.22
February	5,420	600	3,400	.756	.82
March	28,889	2,250	10,000	2.22	2.56
April	47,275	19,403	27,600	6.13	6.84
May	19,915	9,121	12,900	2.87	3.31
June	15,567	1,612	5,540	1.23	1.37
July	2,463	760	1,310	.291	.34
August	2,030	677	1,270	.282	.33
September	4,329	849	2,540	.565	.61
October	32,235	748	7,050	1.52	1.74
November	21,688	6,341	10,800	2.40	2.68
December	11,556	2,861	8,640	1.92	2.21
The year	47,275	600	7,980	1.77	24.03

Cedar River near Indian Lake, N. Y.

Location.—At the steel highway bridge about 2 miles west of Indian Lake village, on the road leading to Blue Mountain lake, about 12 miles by river above its confluence with the Hudson, 8 miles by river above the mouth of Rock river (tributary from the left) and 10 miles by river below Cedar River Flow (Wakely dam).

Records available.—July 15, 1911, to December 31, 1912. Published also in annual report of the United States Geological Survey.

Drainage area.— 85 square miles.* (From U. S. G. S. Topographic Sheets.)

Gage.— Standard chain and weight.

Channel.— Coarse gravel and small boulders, fairly permanent. Low water control is gravel rift about 200 feet below the bridge.

Storage.— The basin contains many lakes and swamps affording favorable sites for storage reservoirs which would be influential in regulating the discharge of the Hudson river. Those that are important are the Cedar lakes and Cedar River Flow. Cedar River Flow is controlled by a lumberman's dam and is used principally during the logging season.

Accuracy.— Discharge rating curve not yet determined.

Discharge measurements of Cedar River near Indian Lake, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
Mar. 11 *a*	Frank Weber	4.41	50.5
June 24	G. H. Canfield	2.86	54.2

* Drainage area of 95 square miles as given in the First Annual Report, Conservation Commission, is erroneous

a Made under complete ice cover.

Daily gage height, in feet, of Cedar River near Indian Lake, N. Y., for 1912.

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	6.4	9.85	4.85	2.6	2.5	2.85	3.35	3.1	3.3
2	......	7.1	3.85	4.15	2.6	2.5	2.9	3.7	4.05	3.3
3	......	6.8	4.85	3.4	2.6	2.9	3.2	3.65	3.6	5.75
4	......	6.4	10.05	3.95	2.6	2.95	3.05	3.6	3.4	5.3
5	......	6.25	5.35	4.0	2.55	2.8	2.95	3.4	3.35	5.2
6	......	6.9	5.45	3.8	2.8	2.8	3.1	3.2	3.3	5.2
7	......	9.7	5.35	3.75	2.7	2.75	3.05	3.15	3.4	4.7
8	......	10.15	3.65	2.9	2.65	2.55	2.9	3.05	6.8	4.65
9	......	8.95	3.45	3.95	2.6	2.55	2.85	3.1	6.7	4.25
10	......	8.0	3.55	3.0	2.6	2.6	2.85	3.25	6.0	6.15
11	4.35	6.6	3.45	4.3	2.65	2.8	2.9	3.0	5.8	5.6
12	4.45	6.25	3.65	4.0	2.65	2.85	2.8	3.25	5.0	4.8
13	4.35	5.5	3.6	3.9	2.65	2.8	2.8	3.3	3.95	4.8
14	4.45	6.15	9.65	3.75	3.9	2.8	2.8	3.1	3.6	4.75
15	4.4	6.1	3.3	3.0	3.5	2.65	2.75	3.05	3.5	4.7
16	5.8	9.65	3.5	2.95	2.9	2.6	3.3	2.8	3.65	4.7
17	6.55	9.55	4.35	2.85	2.7	2.55	3.0	2.8	3.45	4.5
18	6.15	7.4	5.45	2.9	2.6	2.6	2.9	2.85	3.4	4.7
19	5.9	7.05	5.65	2.85	3.0	2.65	3.1	2.95	4.75	4.9
20	6.0	6.1	5.95	2.85	2.5	2.6	3.35	3.0	4.55	5.4
21	6.0	5.75	6.05	2.95	3.3	2.6	3.4	2.8	4.7	5.35
22	5.75	6.3	6.45	2.85	3.2	2.95	4.35	2.9	4.3	5.25
23	5.6	10.15	5.95	2.8	2.6	2.8	4.5	3.0	3.6	4.95
24	5.75	4.85	9.0	2.8	2.7	2.8	3.6	3.9	3.3	4.9
25	5.5	4.25	5.0	2.82	2.6	2.75	3.7	6.3	3.5	4.85
26	5.3	4.4	4.65	2.78	2.6	2.7	3.95	5.6	3.45	4.45
27	5.6	4.45	4.25	2.75	2.6	2.8	4.2	5.35	3.4	4.4
28	5.25	9.15	4.25	2.7	2.5	2.85	3.7	4.65	3.1	4.4
29	5.5	4.1	4.0	2.65	2.5	2.75	3.3	4.4	2.8	4.4
30	6.0	3.85	5.65	2.6	2.6	2.7	3.3	4.2	3.3	4.35
31	6.1	......	5.15	......	2.6	2.8	......	4.15	......	4.3

NOTE.— Relation of gage height to discharge affected by ice March 11th to April 15th. Ice and log jam April 16th. River open April 17th.

Indian Lake Reservoir at Indian Lake, N. Y.

Location.— At the masonry storage dam at the outlet of Indian Lake, about 7½ miles above the confluence of Indian river with the Hudson, and about 23½ miles above the village of North Creek.

Records available.— July 22, 1900, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 131 square miles, including about 9.3 square miles of water surface in Indian Lake at the elevation of the crest of the dam. (From U. S. G. S. topographic sheets.)

Gage.— Staff, read once daily. November 17, 1911, a chain gage was installed on the crest of the dam to replace the staff gage. Datum of both gages the same and unchanged since the establishment of the station.

Discharge measurements.— The record at this station includes elevation of water surface in the reservoir, depth of water flowing over the spillway or flashboards, depth of opening, and the effective head on each of the 5-foot sluice gates. A meteorologic station has also been established at the dam by the United States Weather Bureau and records are kept of the rainfall, temperature, etc. The length of the crest of the dam is 106.65 feet in the clear. To facilitate the calculation of discharge over the spillway, experiments were made at Cornell University in 1899 on a full size model of the spillway section, 6.58 feet long from which the coefficient of discharge has

been determined. No computations of discharge have been made pending current meter measurements to rate discharge through gates. At present record of reservoir level and gate openings alone are obtainable. The elevation of the crest of the spillway above the mean tide is 1,650 feet.

Regulation.— The flow of the upper Hudson has been controlled to a considerable extent during the dry season by the use of Indian Lake reservoir since its completion in 1899. Total storage provided, about 4,700,000,000 cubic feet, affording a discharge of nearly 600 second-feet for a period of 90 to 130 days each year.

Maximum and minimum gage heights.— Maximum gage height at Indian Lake reservoir since the establishment of the station recorded April 27, 1908, 37.00 feet; minimum gage height recorded March 9 to 18, 1907, and January 3 to 17, 1910, 2.00 feet.

Co-operation.— Station maintained in co-operation with the State Engineer and Surveyor of New York and United States Geological Survey.

Daily gage height, in feet, of Indian Lake Reservoir at Indian Lake, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	29.35	26.5	17.35	15.2	34.55	34.95	32.6	26.2	16.9	14.6	17.3	23.8
2......	29.45	26.2	17.0	15.5	34.65	34.9	32.45	26.0	16.6	14.7	17.7	24.0
3......	29.55	25.9	16.7	15.8	34.8	34.8	32.3	25.8	16.4	14.8	17.9	24.3
4......	29.65	25.55	16.4	16.05	34.9	34.7	32.2	25.4	16.15	14.9	18.1	24.6
5......	29.75	25.2	16.1	16.45	35.0	34.6	32.1	25.05	15.95	15.0	18.3	24.9
6......	29.8	24.85	15.8	16.45	35.1	34.5	32.0	24.7	15.7	15.05	18.4	25.2
7......	29.7	24.5	15.5	17.7	35.15	34.4	31.9	24.4	15.5	15.1	18.65	25.5
8......	29.5	24.2	15.2	18.8	35.1	34.3	31.8	24.05	15.25	15.1	19.7	25.85
9......	29.3	23.9	14.95	19.7	35.15	34.3	31.3	23.75	15.0	14.9	20.5	25.95
10......	29.4	23.55	14.7	20.3	35.0	34.3	31.05	23.4	14.7	14.75	21.0	26.0
11......	29.45	23.15	14.45	20.6	34.85	34.25	30.8	23.05	14.4	14.65	21.25	26.1
12......	29.5	22.85	14.2	20.9	34.8	34.15	30.55	22.9	14.1	14.65	21.5	26.2
13......	29.55	22.55	13.95	21.2	34.72	34.1	30.35	22.6	13.8	14.5	21.7	26.3
14......	29.6	22.25	13.7	21.9	34.75	34.05	30.15	22.2	13.6	14.4	21.95	26.4
15......	29.65	21.85	13.5	22.9	34.8	34.05	29.9	21.9	13.3	14.3	22.2	26.5
16......	29.7	21.5	13.3	23.9	34.85	34.0	29.65	21.6	13.2	14.2	22.35	26.6
17......	29.55	21.15	13.1	24.9	35.1	34.0	29.5	21.15	13.1	14.3	22.55	26.7
18......	29.35	20.85	13.0	25.7	35.2	34.0	29.25	20.9	13.0	14.4	22.65	26.75
19......	29.1	20.5	13.2	26.7	35.2	33.95	29.0	20.6	13.0	14.5	22.8	26.9
20......	28.9	20.2	13.5	27.5	35.25	33.9	28.7	20.3	13.15	14.55	22.9	27.1
21......	28.7	19.9	13.6	28.2	35.4	33.85	28.65	20.05	13.25	14.65	23.0	27.3
22......	28.5	19.6	13.7	28.9	35.6	33.8	28.4	19.8	13.4	14.75	23.1	27.4
23......	28.3	19.3	13.8	30.4	35.65	33.8	28.2	19.55	13.5	14.85	23.15	27.5
24......	28.1	18.95	13.9	31.3	35.6	33.7	28.0	19.25	13.6	15.0	23.2	27.6
25......	27.95	18.7	14.0	31.85	35.5	33.55	27.8	19.0	13.75	15.75	23.35	27.7
26......	27.8	18.4	14.15	32.3	35.4	33.35	27.6	18.7	14.0	16.2	23.5	27.8
27......	27.65	18.15	14.25	33.0	35.25	33.25	27.35	18.4	14.15	16.6	23.6	27.9
28......	27.45	17.9	14.35	33.6	35.1	33.15	27.1	18.1	14.25	16.8	23.65	28.0
29......	27.25	17.65	14.45	34.1	35.0	32.95	26.85	17.8	14.35	16.95	23.7	28.1
30......	27.05	......	14.6	34.35	34.95	32.75	26.7	17.5	14.4	17.1	23.75	28.2
31......	26.85	......	14.85	......	35.0	......	26.45	17.2	......	17.2	......	28.25

Gate openings in feet of Indian Lake Reservoir at Indian Lake, N. Y., for 1912.

DATE.	Sluice Gate A open.	Sluice Gate B open.
Jan. 7–Jan. 9	....	5.0
Jan. 16–Mar. 17	....	5.0
Jan. 31–Feb. 14	2.5	....
Feb. 15–Mar. 17	3.0	....
May 6–May 14	.6	....
June 23–July 7	....	2.5
Jyly 8–July 9 *a*	5.0	....
July 8–Sept. 18	....	5.0
Aug. 2–Sept. 18	2.5	....
Oct. 8–Oct. 16	....	5.0

a This date not recorded. Estimated from gage heights on Indian River at Indian Lake.

Indian River near Indian Lake, N. Y.

Location.— About three-fourths of a mile below State dam, at the outlet of Indian lake, one mile above the mouth of Big Brook and eight miles above the point where it enters the Hudson. Big Brook is the only important tributary of Indian river below this station.

Records available.— Miscellaneous measurements, 1911; July 1 to December 31, 1912.

Drainage area.— 132 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Vertical staff, nailed to stump.

Channel.— Pond of still water at head of rocky rapids.

Artificial control.— The flow of Indian river is controlled at the lake.

Discharge measurements.—Are made at present by wading at head of rapids about 150 feet below gage. A cable is to be installed at this section.

Winter flow.— Because of the swift current in the rapids the water probably does not freeze in winter on the control and, although it will form around the gage in the still water, the relation of gage height to discharge will probably not be seriously affected.

Accuracy.— There is a well defined rock control, which is permanent, below the station. The rating curve is not yet developed.

Discharge measurements of Indian River near Indian Lake, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 27 *a*	G. H. Canfield	2.34	364
27 *b*	G. H. Canfield	1.12	83.1

a Made at bridge.
b Made by wading 150 feet below gage.

Daily gage height, in feet, of Indian River near Indian Lake, N. Y., for 1912.
[Lester Severie, observer.]

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.55	2.85	.15	.15	.1
2	2.3	2.55	2.85	.1	.15	.15
3	2.3	3.25	2.85	.1	.15	.2
4	2.3	3.25	2.8	.1	.15	.2
5	2.3	3.25	2.8	.1	.15	.2
6	2.3	3.25	2.8	.1	.15	.2
7	2.3	3.25	2.75	.1	.15	.25
8	3.65	3.2	2.75	.1	.4	.25
9	3.65	3.2	2.75	2.2	.3	.25
10	2.75	3.2	2.75	2.2	.2	.25
11	2.75	3.2	2.7	2.2	.2	.25
12	2.75	3.15	2.7	2.2	.15	.25
13	2.7	3.15	2.7	2.15	.15	.25
14	2.7	3.15	2.65	2.15	.2	.25
15	2.7	3.15	2.65	2.15	.2	.25
16	2.7	3.1	2.65	2.15	.15	.25
17	2.7	3.1	2.6	.1	.15	.25
18	2.7	3.1	2.6	.1	.15	.25
19	2.65	3.05	.1	.1	.15	.3
20	2.65	3.05	.1	.1	.15	.3
21	2.65	3.05	.1	.1	.15	.3
22	2.65	3.05	.1	.1	.15	.3
23	2.65	3.05	.15	.15	.15	.3
24	2.65	3.0	.15	.15	.15	.3
25	2.6	3.0	.15	.15	.15	.3
26	2.6	3.0	.15	.15	.15	.3
27	2.6	2.95	.15	.15	.15	.25
28	2.6	2.95	.15	.15	.15	.25
29	2.6	2.95	.15	.15	.1	.4
30	2.6	2.9	.15	.15	.1	.4
31	2.6	2.9	......	.15	......	.4

SCHROON RIVER DRAINAGE BASIN.

Description.

Schroon river rises in Essex county, along the southern slopes of the highest mountains in the Adirondack group, flows in a general southerly direction for about 45 miles through Essex and Warren counties, and joins the Hudson near Thurman. Its total drainage area is 550 square miles. Its headwaters reach an elevation of about 2,000 feet above mean tide, while at its mouth it is at an elevation of about 600 feet.

Its basin is largely forested and contains considerable wild land and numerous lakes and ponds. The most important of these is Schroon lake, through which the river flows, which has a water surface area of about 6.3 square miles. The river affords excellent opportunities for storage and power development, which are under investigation by the New York State Conservation Commission. The only power developments are at Warrensburg.

Schroon River at Riverbank, N. Y.

Location.—At the highway bridge 12 miles above the confluence of Schroon river with the Hudson, 9 miles below the mouth of Schroon lake, about 3½ miles below the outlet of Grant lake (coming in from the left), and 1 mile below Tumblehead falls which extend upstream about a mile farther. The station is about 9 miles north of Warrensburg where there are several dams used for power development.

Records available.— September 2, 1907, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply

Commission, State Conservation Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 534 square miles. (From U. S. G. S. water supply papers.)

Gage.— Chain; read once daily; datum unchanged.

Channel.— Gravel; smooth and permanent.

Discharge measurements.— Made from bridge.

Artificial control.— Since 1907 the regimen of flow of Schroon river, from the low water period to the high, has been somewhat affected by storage in Schroon lake. In September, 1907, a timber crib dam was constructed at Starbuckville about 6 miles above the station. This dam affords a head of about 8 feet and ponds water to Schroon lake.

Winter flow.—Affected by ice. Measurements made through the ice have developed a fairly good ice discharge curve.

Accuracy.— Open water curve well developed.

Discharge measurements of Schroon River at Riverbank, N. Y, in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
1912.		*Feet.*	*Second-feet.*
Jan. 21 *a*	G. H. Canfield	3.60	546
Feb. 9 *b*	Frank Weber	2.80	394
Mar. 1 *b*	Alexander McMillan	2.66	330
June 7 *c*	Frank Weber	3.62	1,090
7 *c*	Frank Weber	3.61	1,090

a Measurement made under complete ice cover 2,000 feet down stream from bridge.
b Made at regular section, under complete ice cover.
c Log-jam below gage.

Daily gage height, in feet, of Schroon River at Riverbank, N. Y., for 1912.

[J. H. Roberts, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.6	3.0	2.66	2.8	4.7	4.5	1.35	1.35	1.3	1.3	3.1	2.9
2	3.6	2.8	2.5	3.6	4.4	4.3	1.35	1.35	1.45	1.32	3.1	2.85
3	3.6	3.4	2.55	3.8	4.2	4.3	1.25	1.35	1.5	1.28	2.95	2.95
4	3.5	3.3	2.5	3.8	4.2	4.0	1.2	1.3	1.45	1.3	2.9	3.0
5	3.4	3.2	2.4	4.0	4.1	4.0	1.3	1.32	1.45	1.8	2.9	3.1
6	3.9	3.2	2.45	4.4	4.1	3.8	1.35	1.3	1.48	1.3	2.9	3.1
7	4.1	3.0	2.4	5.0	4.4	3.6	1.35	2.1	1.5	2.0	3.0	3.0
8	4.0	2.8	2.3	6.0	4.4	3.4	1.38	1.75	1.5	2.0	3.2	3.3
9	4.4	2.8	2.35	6.8	4.5	3.3	1.35	2.05	1.48	2.0	3.5	3.4
10	4.2	2.85	2.25	6.8	4.3	3.5	1.5	1.55	1.35	2.0	3.8	3.4
11	4.6	2.9	2.25	6.6	4.3	3.8	1.4	1.5	1.5	1.9	3.8	3.4
12	4.5	2.9	2.25	6.2	4.0	3.6	1.4	1.55	1.5	1.85	3.8	3.3
13	4.6	2.9	2.25	5.9	4.3	3.6	1.5	1.5	1.45	1.25	3.8	3.2
14	4.9	2.85	2.3	5.8	3.9	3.4	1.4	1.45	1.5	2.0	3.8	3.1
15	5.2	2.8	2.3	5.6	4.0	3.4	1.35	1.4	2.1	2.0	3.9	3.0
16	4.0	2.75	2.5	5.8	4.4	1.9	1.3	1.38	2.0	2.0	4.0	2.9
17	4.3	2.7	2.5	6.4	4.5	3.0	1.3	1.55	2.0	1.9	4.0	2.8
18	4.0	2.75	2.5	7.0	4.5	2.9	1.35	1.4	2.0	2.0	3.9	2.8
19	4.1	2.55	2.6	7.3	4.6	2.95	1.3	1.4	2.0	1.55	3.7	2.9
20	3.6	2.45	2.55	7.4	4.9	2.85	1.4	1.45	2.0	1.6	3.6	3.0
21	3.0	2.35	2.5	7.1	5.0	2.6	1.4	1.45	1.8	1.95	3.6	3.0
22	2.6	2.4	2.55	6.8	5.4	2.05	1.4	1.45	1.25	2.0	3.5	2.85
23	2.45	2.4	2.6	6.8	5.5	2.3	1.35	1.95	1.8	2.0	3.3	2.9
24	2.45	2.45	2.6	6.9	5.7	2.3	1.4	1.8	2.0	2.25	3.3	2.9
25	3.6	2.5	2.65	6.6	5.8	2.5	1.4	1.35	2.0	2.35	3.3	2.7
26	3.6	2.55	2.55	6.2	5.6	2.5	1.4	2.0	2.05	2.55	3.2	2.6
27	3.4	2.55	2.6	5.9	5.4	2.6	1.4	1.55	2.0	3.0	3.2	2.55
28	......	2.65	2.6	5.6	5.0	1.55	1.35	1.42	1.7	3.0	3.1	2.6
29	3.4	2.6	2.8	5.4	4.8	1.55	1.4	1.32	1.25	3.1	3.0	2.55
30	3.2	......	2.8	5.0	4.6	1.35	1.4	1.28	2.0	3.1	3.0	2.5
31	3.1	......	2.85	......	4.6	......	1.4	1.25	......	3.1	......	1.65

NOTE.— Relation of gage height to discharge affected by ice January 6 to March 26.
Relation of gage height to discharge affected by log jams April 5 to 8, and May 7 to June 13.

Daily discharge, in second-feet, of Schroon River at Riverbank, N. Y., for 1918.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,290	400	330	721	2,440	1,880	143	143	130	130	900	776
2	1,290	400	260	1,290	2,100	1,680	143	143	170	135	900	748
3	1,290	400	282	1,470	1,890	1,680	118	143	184	125	806	806
4	1,200	400	260	1,470	1,890	1,400	105	130	170	130	776	836
5	1,120	400	220	1,400	1,780	1,400	130	135	170	276	776	900
6	1,000	400	240	1,780	1,780	1,240	143	130	178	130	776	900
7	1,050	400	220	2,440	1,780	1,080	143	390	184	350	836	836
8	1,000	395	180	3,690	1,780	940	151	259	184	350	966	1,040
9	950	394	200	5,200	1,880	875	143	370	178	350	1,200	1,120
10	900	420	160	5,200	1,680	1,010	184	198	143	350	1,470	1,120
11	850	445	160	4,900	1,680	1,240	156	184	184	312	1,470	1,120
12	800	445	160	4,310	1,400	1,080	156	198	184	294	1,470	1,040
13	750	445	160	3,900	1,680	1,080	184	184	170	118	1,470	966
14	700	420	180	3,770	1,320	1,120	156	170	184	350	1,470	900
15	650	395	180	3,520	1,400	1,120	143	156	390	350	1,570	836
16	500	372	260	3,770	1,780	312	130	151	350	350	1,670	776
17	600	350	260	4,600	1,880	836	130	198	350	312	1,670	721
18	550	372	290	5,500	1,880	776	143	156	350	350	1,570	721
19	550	283	370	5,960	1,990	806	130	156	350	198	1,380	776
20	546	240	380	6,120	2,320	748	156	170	350	212	1,290	836
21	500	200	390	5,640	2,440	618	156	170	276	331	1,290	836
22	500	220	450	5,200	2,920	370	156	170	118	350	1,200	748
23	440	220	510	5,200	3,040	476	143	331	276	350	1,040	776
24	440	240	540	5,350	3,290	476	156	276	350	454	1,040	776
25	420	260	610	4,900	3,420	568	156	143	350	500	1,040	668
26	400	282	593	4,310	3,160	568	156	350	370	593	966	618
27	390	282	618	3,900	2,920	618	156	198	350	836	966	593
28	370	328	618	3,520	2,440	198	143	162	242	836	900	618
29	390	305	721	3,280	2,210	198	156	135	118	900	836	593
30	390	......	721	2,800	1,990	143	156	125	350	900	836	568
31	400	......	748	......	1,990	......	156	118	......	900	......	226

NOTE.— Daily discharge January 1-5, April 9 to May 6, and June 14 to December 31, determined from a well defined rating curve.

Daily discharge January 6 to April 4, determined by means of a rating curve based on measurements made with ice present, observer's notes, and climatological records.

Daily discharge, April 5 to 8 and May 7 to June 13, determined from a fairly well defined rating curve based on measurements made during the existence of log jams.

Monthly discharge of Schroon River at Riverbank, N. Y., for 1918.

[Drainage area, 534 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	720	1.35	1.56	C
February	....	....	349	.654	.71	C
March	748	160	364	.682	.79	C
April	6,120	721	3,840	7.19	8.02	B
May	3,420	1,320	2,130	3.99	4.60	B
June	1,880	143	885	1.66	1.85	B
July	184	105	148	.277	.32	B
August	390	118	192	.360	.42	B
September	390	118	245	.459	.51	B
October	900	118	391	.732	.84	B
November	1,670	776	1,150	2.15	2.40	B
December	1,120	226	800	1.50	1.73	B
The year	6,120	105	931	1.74	23.75	

SACANDAGA RIVER DRAINAGE BASIN.

Description.

Sacandaga river is formed by three principal branches which unite in the southeastern part of Hamilton county in the Adirondack region. The west branch is the outlet of Piseco lake, the middle branch is the outlet of Sacandaga and Pleasant lakes, while the east and principal branch issues from a series of small ponds and lakes in the southwestern part of Warren county. The east and middle branches unite a few miles north of Wells and are joined by the west branch a short distance below Wells. The river then flows southeasterly to a point about 5 miles below Northville, where it turns and runs northeasterly to the Hudson river at Hadley. Its total drainage area comprises about 1,050 square miles.

Sacandaga lake, the highest of the tributary lakes in the headwaters, is about 1,700 feet above mean tide; at its entrance into the Hudson the Sacandaga is at an elevation of about 550 feet. Between Northville and the mouth of the river there is a fall of about 180 feet (chiefly concentrated in the 5 miles below Conklingville) entirely unutilized. There are, in fact, no power developments on the Sacandaga.

The drainage area of this river is largely in forest. The mean precipitation is high, being about 49 inches, whereas the mean for the whole Hudson drainage area above Mechanicville is only about 43 inches. Possibilities for storage on the Sacandaga are great and the New York State Conservation Commission proposes a high dam at Conklingville, the reservoir to store about 29,000,000,000 cubic feet of water, with a water surface of 42.7 square miles, and controlling practically the entire flow of the Sacandaga basin. This plan proposes also to develop the total fall obtained between Conklingville and the Hudson — approximately 200 feet — which will afford 25,000 to 30,000 continuous horsepower.

Sacandaga River near Hope, N. Y.

Location.— Three and one-half miles above the post office at Hope, 4 miles below the village of Wells, 12 miles above Northville (the nearest railroad station), and 1½ miles below the junction of the east and west branches of the Sacandaga.

Records available.— September 15, 1911, to December 31, 1912.

Drainage area.— 494 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Staff in two sections: A sloping staff reading from 1 foot to 4.30 feet, on a slope of 2.5 to 1; a vertical staff (for high water records) attached to a rocky cliff in line with the sloping gage.

Channel.— Very rough but permanent. Banks are fairly free from timber, high and rocky.

Discharge measurements.— The channel was cleared of boulders to some extent and a cable with a span of 214 feet was erected for making discharge measurements. (See Fig. F.)

Accuracy.— The open water rating curve is well defined and estimates for this period are good.

SACANDAGA RIVER NEAR HOPE, N. Y.
Cable and gaging car.

Fig. F.

Discharge measurements of Sacandaga River near Hope, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
April 3.......	C. S. De Golyer..................................	4.24	2,290
4.......	C. S. De Golyer..................................	4.02	1,910
5.......	C. S. De Golyer..................................	3.99	1,930
5.......	C. S. De Golyer..................................	4.34	2,420
6.......	C. S. De Golyer..................................	5.01	3,820
8.......	C. S. De Golyer..................................	6.7	8,440
9.......	C. S. De Golyer..................................	5.65	5,400
Aug. 6 *a*......	J. G. Mathers..................................	1.53	75.4
Sept. 12 *b*......	G. H. Canfield..................................	1.755	141
13 *a*......	G. H. Canfield..................................	1.5	71.5

a Measurement made by wading at regular section.
b Measurement made by wading at regular section.

Daily gage height, in feet, of Sacandaga River near Hope, N. Y., for 1911.
[Edgar Coulombe, observer.]

DAY.	Sept.	Oct.	Nov.	Dec.	DAY.	Sept.	Oct.	Nov.	Dec.
1..............	......	2.28	3.2	3.5	17..............	2.29	2.41	3.2	4.4
2..............	......	2.8	3.1	3.65	18..............	2.16	3.3	4.3	4.1
3..............	......	2.7	3.0	3.35	19..............	2.05	4.5	3.95	3.85
4..............	......	3.95	2.9	3.0	20..............	1.98	4.1	3.75	3.45
5..............	......	3.45	2.85	2.9	21..............	1.92	3.9	3.6	3.5
6..............	......	3.1	2.8	3.0	22..............	1.96	3.8	3.45	3.5
7..............	......	3.15	3.25	2.9	23..............	1.96	4.5	3.2	5.6
8..............	......	3.25	4.1	2.8	24..............	1.92	4.2	3.3	4.9
9..............	......	3.2	3.85	2.85	25..............	1.89	3.9	3.2	4.4
10..............	......	3.05	3.7	3.05	26..............	1.84	3.65	3.1	4.3
11..............	......	2.95	3.7	3.45	27..............	1.83	3.45	3.05	4.2
12..............	......	2.8	3.6	4.3	28..............	1.83	3.35	2.95	4.0
13..............	......	2.7	4.0	5.2	29..............	2.0	3.25	3.8	3.5
14..............	......	2.6	3.8	4.8	30..............	2.32	3.1	3.7	3.6
15..............	2.24	2.5	3.65	4.4	31..............	......	3.1	......	......
16..............	2.43	2.44	3.5	4.1					

Daily gage height, in feet, of Sacandaga River near Hope, N. Y., for 1912.
[Edgar Coulombe, observer.]

DAY.	Jan.	Feb.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.55	5.5	4.4	4.2	3.7	1.67	1.44	1.36	2.34	3.0	2.65
2	3.4	5.0	4.4	4.2	3.45	1.65	1.48	1.6	2.44	3.3	2.75
3	3.25	4.8	4.2	4.0	3.4	1.71	1.58	1.86	2.31	3.15	5.0
4	3.1	4.8	4.1	4.0	3.25	1.7	1.56	2.0	2.3	3.0	4.4
5	3.1	4.7	4.2	3.6	3.1	1.64	1.54	1.85	2.24	2.95	4.2
6	2.9	4.7	5.4	4.2	2.95	1.62	1.52	1.78	2.2	2.9	4.2
7	2.8	4.6	6.7	4.1	2.9	1.66	1.48	1.83	2.13	3.45	4.3
8	2.9	......	6.6	3.95	2.85	1.74	1.48	1.73	2.06	6.0	4.1
9	2.85	......	5.6	3.8	2.75	1.65	1.47	1.72	2.01	5.0	3.55
10	2.85	......	5.1	3.85	2.6	1.59	1.52	1.6	2.02	4.5	3.6
11	2.9	......	4.8	3.9	2.5	1.54	1.74	1.64	2.1	4.2	3.55
12	3.0	......	4.5	3.9	2.42	1.57	1.8	1.68	2.23	3.9	3.2
13	3.7	......	5.0	3.7	2.4	1.48	1.55	1.5	2.28	3.8	2.95
14	4.0	......	4.7	3.65	2.32	1.6	1.6	1.52	2.3	3.85	3.0
15	4.6	......	5.5	3.7	2.29	1.87	1.47	1.6	2.2	3.9	3.0
16	4.8	......	6.6	3.9	2.3	1.88	1.52	2.5	2.14	3.7	2.95
17	5.0	......	6.8	4.4	2.3	1.68	1.52	2.44	2.08	3.6	2.8
18	5.1	......	6.6	4.9	2.25	1.57	1.54	2.02	2.05	3.5	2.85
19	5.3	......	6.6	4.2	2.18	1.62	1.58	2.16	2.2	3.4	3.3
20	5.8	......	6.0	4.5	2.04	1.47	1.56	2.2	2.6	3.3	3.5
21	6.0	......	5.7	5.3	1.94	1.56	1.54	2.1	2.55	3.2	3.5
22	6.0	......	5.6	4.5	1.98	2.0	1.65	2.01	2.48	3.1	3.25
23	6.0	......	7.1	5.1	1.83	1.84	1.73	1.96	2.65	3.05	3.15
24	6.0	......	6.1	4.7	1.87	1.68	1.73	2.2	4.1	3.0	3.05
25	6.0	......	5.6	4.6	1.83	1.77	1.65	2.6	5.1	3.0	3.0
26	5.7	......	5.5	4.1	1.84	1.66	1.66	2.85	4.3	3.0	2.8
27	5.5	......	5.1	4.0	1.82	1.54	1.66	2.60	3.95	2.9	2.85
28	5.5	......	4.8	3.75	1.74	1.42	1.61	2.48	3.65	2.7	2.75
29	5.5	......	4.2	3.45	1.7	1.39	1.58	2.36	3.5	2.65	2.75
30	5.5	......	4.5	4.0	1.69	1.4	1.46	2.38	3.3	2.75	2.75
31	5.5	......	......	3.9	......	1.42	1.45	......	3.05	......	3.4

NOTE.— Relation of gage height to discharge affected by ice, January 11 to March 21, 1912.

Daily discharge, in second-feet, of Sacandaga River near Hope, N. Y., for 1911.

DAY.	Sept.	Oct.	Nov.	Dec.	DAY.	Sept.	Oct.	Nov.	Dec.
1	......	358	990	1,290	17	362	424	990	2,560
2	......	666	900	1,460	18	303	1,090	2,390	2,070
3	......	598	820	1,140	19	256	2,740	1,850	1,720
4	......	1,850	740	820	20	227	2,070	1,580	1,240
5	......	1,240	703	740	21	204	1,780	1,400	1,290
6	......	900	666	820	22	219	1,650	1,240	1,290
7	......	945	1,040	740	23	219	2,740	990	5,250
8	......	1,040	2,070	666	24	204	2,230	1,090	3,540
9	......	990	1,720	703	25	192	1,780	990	2,560
10	......	860	1,520	860	26	174	1,460	900	2,390
11	......	780	1,520	1,240	27	171	1,240	860	2,230
12	......	666	1,400	2,390	28	171	1,140	780	1,920
13	......	598	1,920	4,230	29	235	1,040	1,650	1,290
14	......	534	1,650	3,330	30	377	900	1,520	1,400
15	339	474	1,460	2,560	31	......	900	......	1,370
16	435	440	1,290	2,070					

Daily discharge, in second-feet, of Sacandaga River near Hope, N. Y., for 1912.
[Edgar Coulombe, observer.]

DAY.	Jan.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,340	2,560	2,230	1,520	118	57	40	387	820	566
2	1,190	2,560	2,230	1,240	112	66	97	440	1,090	632
3	1,040	2,230	1,920	1,190	130	92	182	372	945	3,760
4	900	2,070	1,920	1,040	127	87	235	367	820	2,560
5	900	2,230	1,400	900	109	81	178	339	780	2,230
6	740	4,730	2,230	780	103	76	153	321	740	2,230
7	666	8,450	2,070	740	115	66	171	290	1,240	2,390
8	740	8,140	1,850	703	140	66	137	260	6,350	2,070
9	703	5,250	1,650	632	112	64	134	239	3,760	1,340
10	703	3,990	1,720	534	94	76	97	243	2,740	1,400
11	......	3,330	1,780	474	81	140	109	277	2,230	1,340
12	......	2,740	1,780	429	89	160	121	335	1,780	990
13	......	3,760	1,520	418	66	84	71	358	1,650	780
14	......	3,130	1,460	377	97	97	76	367	1,720	820
15	......	4,990	1,520	362	185	64	97	321	1,780	820
16	......	8,140	1,780	367	189	76	474	295	1,520	780
17	......	8,760	2,560	367	121	76	440	269	1,400	666
18	......	8,140	3,540	344	89	81	243	256	1,290	703
19	......	8,140	2,230	312	103	92	303	321	1,190	1,090
20	......	6,350	2,740	252	64	87	321	534	1,090	1,290
21	......	5,520	4,480	212	87	81	277	504	990	1,290
22	......	5,250	2,740	227	235	112	239	463	900	1,040
23	......	9,690	3,990	171	174	137	219	566	860	945
24	......	6,640	3,130	185	121	137	321	2,070	820	860
25	......	5,250	2,930	171	150	112	534	3,990	820	820
26	......	4,990	2,070	174	115	115	703	2,390	820	666
27	......	3,990	1,920	167	81	115	534	1,850	740	703
28	......	3,330	1,580	140	53	100	463	1,460	598	632
29	......	2,230	1,240	127	46	92	398	1,290	566	632
30	......	2,740	1,920	124	48	62	408	1,090	632	632
31	......	......	1,780	......	53	60	......	860	......	1,190

NOTE.— Daily discharge, September 15, 1911, to January 10, 1912, and April 1 to December 31, 1912, determined from a well-defined rating curve.

Monthly discharge of Sacandaga River near Hope, N. Y., for 1911.
[Drainage area, 494 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
September 15–30	435	171	256	.518	.31	A
October	2,740	358	1,170	2.37	2.73	A
November	2,390	666	1,290	2.61	2.91	A
December	5,250	666	1,840	3.72	4.29	A

Monthly discharge of Sacandaga River near Hope, N. Y., for 1912.
[Drainage area, 494 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	600	1.21	1.40	C
February	....	....	300	.607	.65	C
March	....	....	900	1.82	2.10	C
April	9,690	2,070	4,980	10.1	11.27	A
May	4,480	1,240	2,190	4.43	5.11	A
June	1,520	124	489	.990	1.10	A
July	235	46	110	.223	.26	A
August	160	57	90.7	.184	.21	A
September	703	40	259	.524	.58	A
October	3,990	239	1,750	1.51	1.74	A
November	6,350	566	1,420	2.87	3.20	A
December	3,760	566	1,220	2.47	2.85	A
The year	9,690	40	1,110	2.25	30.47	

NOTE.— Discharge January 11 to March 31, 1912, estimated by comparison with the discharge at Hadley.
Mean discharge January 11 to 31, 1912, estimated 460 second-feet.

Sacandaga River at Hadley, N. Y. (Cable Station.)

Location.—About half a mile west of the railroad station at Hadley, 1 mile above the confluence of Sacandaga river with the Hudson, and 4½ miles below the site of the proposed storage dam at Conklingville. No tributaries between this station and the mouth of the river. Location selected to avoid inaccuracies in the records caused by back water from log jams. This station replaces the upper bridge station and the lower bridge station.

Records available.— September 13, 1907, to December 31, 1910, upper bridge station; September 24, 1909, to July 7, 1911, lower bridge station; January 1, 1911, to December 31, 1912, present station. Records also found in the United States Geological Survey water supply papers.

Drainage area.— 1,060 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Recording hydrograph (Barrett-Lawrence type) 30 feet downstream from the cable, in a concrete well 3 feet square, inside dimensions. The bottom of the well is about 2 feet below low water and 12 feet below ground surface. It is connected with the river by a 4-inch cast-iron water pipe 48 feet long, its intake end pointing downstream and protected by a fine wire screen. Inside the well and securely bolted to the side is a staff gage, its zero at elevation 573.36 and referred to a United States Geological Survey aluminum tablet set in the foundation wall of the Union Bag and Paper Company's mill at Hadley. On top of the well is a concrete shelter 6 feet high and 3 feet square, inside dimensions, for protecting the recording gage. The staff gage is used only as a reference gage. (See Fig. A.)

Channel.—Very rough but permanent. The channel at the cable was cleared of boulders as far as feasible, so that fairly accurate discharge measurements can be made at medium and high stages. Low water measurements are made at a section about three-fourths mile above the cable, where the bottom is smooth and gravelly. Measurements at this point are made from a boat or by wading.

Winter flow.— The water in the well and in the intake pipe never freezes because its level is below the frost line. The relation of gage height to discharge is, however, considerably affected by ice in the river.

Accuracy.— The discharge rating curve which has been developed for this station is well defined.

Discharge measurements of Sacandaga River at Hadley, N. Y. (Cable Station), in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 18 *a*.....	G. H. Canfield..................................	5.08	774
21 *b*......	Frank Weber..................................	5.40	1,010
Feb. 7 *b*......	do	4.43	580
28 *c*......	Alexander McMillan..............................	4.11	650
Mar. 8 *c*......	Frank Weber..................................	3.62	537
15 *c*......	do	4.18	775
22 *d*.....	do	6.16	3,710
29 *d*.....	do	5.22	2,440
June 20.......	G. H. Canfield..................................	3.28	530
July 3.......	do	2.69	195
5.......	do	2.76	229
17.......	O. W. Hartwell..................................	2.80	275
Aug. 2 *e*......	J. G. Mathers..................................	2.40	104

a Made at boat section ¼ mile above cable under partial ice cover.
b Made at highway bridge below cable under partial ice cover.
c Made at boat section, under complete ice cover.
d Made from cable, partial ice cover.
e Made by wading about ¼ mile above gage.

Daily gage height, in feet, of Sacandaga River at Hadley, N. Y. (Cable Station), for 1912.

[B. & L. Recording Gage.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.2	4.4	4.2	7.1	6.2	5.3	2.78	2.37	2.6	3.7	4.7	3.95
2.....	4.9	4.4	4.15	7.4	5.9	5.1	2.73	2.42	2.6	3.65	4.6	4.1
3.....	4.6	4.5	4.1	7.4	5.7	4.9	2.7	2.54	2.64	3.65	4.7	5.6
4.....	4.45	4.45	4.05	7.3	5.5	4.7	2.7	2.52	3.0	3.65	4.6	6.1
5.....	4.4	4.5	3.85	7.4	5.4	4.5	2.77	2.53	3.15	3.55	4.4	6.1
6.....	4.2	4.4	3.9	7.3	5.1	4.35	2.72	2.53	3.1	3.5	4.25	6.1
7.....	4.1	4.45	3.75	7.8	5.2	4.25	2.67	2.51	3.05	3.4	4.4	6.1
8.....	4.05	4.45	3.65	8.4	5.3	4.2	2.66	2.48	2.98	3.3	5.9	6.0
9.....	4.05	4.4	3.7	9.0	5.2	4.05	2.67	2.47	2.92	3.2	6.6	5.8
10.....	4.0	4.45	3.8	8.5	5.0	3.9	2.68	2.59	2.87	3.2	6.7	5.4
11.....	4.3	......	3.9	7.8	4.9	3.8	2.65	2.73	2.85	3.2	6.5	5.3
12.....	4.6	......	3.7	7.2	4.9	3.7	2.62	2.84	2.81	3.3	6.2	5.0
13.....	5.0	4.5	3.8	6.8	4.7	3.6	2.59	2.86	2.8	3.4	5.9	4.4
14.....	5.2	4.4	4.05	6.7	5.0	3.5	2.7	2.79	2.8	3.4	5.7	4.3
15.....	5.1	4.3	4.2	6.7	5.0	3.5	2.75	2.69	2.82	3.45	5.6	4.3
16.....	5.0	4.15	5.4	7.0	5.0	3.45	2.8	2.68	3.1	3.45	5.4	4.3
17.....	5.1	3.95	6.1	7.6	5.4	3.4	2.8	2.59	3.45	3.4	5.2	4.2
18.....	5.1	3.8	6.2	8.4	5.7	3.4	2.75	2.61	3.45	3.35	5.0	4.15
19.....	4.9	3.75	6.4	8.7	5.8	3.35	2.70	2.63	3.55	3.3	4.9	4.4
20.....	5.0	3.75	6.4	8.7	5.6	3.25	2.64	2.63	3.75	3.4	4.7	4.9
21.....	5.3	3.8	6.3	8.3	5.8	3.2	2.64	2.62	3.65	3.7	4.6	5.0
22.....	5.4	4.1	6.3	7.9	6.3	3.15	2.71	2.63	3.55	3.7	4.5	4.8
23.....	......	4.6	6.1	7.8	6.6	3.1	2.80	2.66	3.45	3.8	4.4	4.6
24.....	......	4.5	5.9	8.0	6.6	......	2.86	2.67	3.4	5.1	4.3	4.4
25.....	......	4.4	5.7	8.0	6.4	......	2.75	2.71	3.5	6.1	4.35	4.2
26.....	......	4.25	5.5	7.6	6.3	......	2.62	2.73	4.1	6.4	4.4	4.1
27.....	......	4.2	5.2	7.3	6.0	......	2.62	2.74	4.2	6.4	4.35	4.05
28.....	4.9	4.2	5.0	7.0	5.7	......	2.59	2.71	4.0	6.1	4.25	4.05
29.....	4.6	4.2	5.4	6.8	5.4	2.82	2.57	2.69	3.85	5.7	4.05	4.05
30.....	4.45	......	6.2	6.4	5.5	2.8	2.55	2.69	3.7	5.3	4.0	4.1
31.....	4.4	......	6.7	......	5.5	......	2.48	2.66	......	5.0	......	4.35

NOTE.— Relation of gage height to discharge affected by ice January 9 to April 3.
On days having little fluctuation in stage the mean gage height was obtained by an inspection of the hydrograph traced by the gage; on days when the fluctuation was considerable, the mean gage height is the average of six readings during each 24 hour period.

Daily discharge, in second-feet, of Sacandaga River at Hadley, N. Y. (Cable Station), for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,890	580	750	7,470	5,080	3,080	254	95	176	864	2,050	1,110
2	2,370	580	722	8,430	4,360	2,710	232	111	176	821	1,900	1,270
3	1,900	600	695	8,430	3,900	2,370	218	153	193	821	2,050	3,680
4	1,700	590	670	8,180	3,470	2,050	218	146	366	821	1,900	4,840
5	1,630	600	580	8,480	3,270	1,760	250	149	455	738	1,630	4,840
6	1,380	580	600	8,180	2,710	1,570	227	149	424	698	1,440	4,840
7	1,270	590	545	9,680	2,890	1,440	205	142	395	622	1,630	4,840
8	1,220	590	518	11,500	3,080	1,380	201	131	355	552	4,360	4,600
9	1,220	580	530	13,300	2,890	1,220	205	128	323	486	6,120	4,130
10	1,000	590	560	11,800	2,540	1,060	210	172	297	486	6,400	3,270
11	920	593	600	9,680	2,370	956	197	232	288	486	5,850	3,080
12	840	597	530	7,880	2,370	864	184	283	268	552	5,080	2,540
13	750	600	560	6,690	2,050	778	172	292	263	622	4,360	1,630
14	850	580	670	6,400	2,540	698	218	258	263	622	3,900	1,500
15	795	565	750	6,400	2,540	698	240	214	273	660	3,680	1,500
16	750	722	2,160	7,280	2,540	660	263	210	424	660	3,270	1,500
17	795	622	3,540	9,080	3,270	622	263	172	660	622	2,890	1,380
18	795	560	3,760	11,500	3,900	622	240	180	660	587	2,540	1,330
19	710	545	4,200	12,400	4,130	587	218	189	738	552	2,370	1,630
20	750	545	4,200	12,400	3,680	519	193	189	910	622	2,050	2,370
21	915	560	3,980	11,200	4,130	486	193	184	821	864	1,900	2,540
22	990	695	3,970	9,980	5,330	455	222	189	738	864	1,760	2,210
23	943	1,060	3,650	9,680	6,120	424	263	197	660	956	1,630	1,900
24	897	960	3,350	10,300	6,120	395	292	205	622	2,710	1,500	1,630
25	850	880	3,050	10,300	5,590	366	240	222	698	4,840	1,570	1,380
26	803	780	2,770	9,080	5,330	339	184	232	1,270	5,590	1,630	1,270
27	756	750	2,360	8,180	4,600	312	184	236	1,380	5,590	1,570	1,220
28	710	750	2,100	7,280	3,900	297	172	222	1,160	4,840	1,440	1,220
29	620	750	2,760	6,690	3,270	273	165	214	1,010	3,900	1,220	1,220
30	590	......	4,760	5,590	3,470	263	157	214	864	3,080	1,160	1,270
31	580	......	6,220	......	3,470	......	131	201	......	2,540	......	1,570

NOTE.— Daily discharge, January 1 to 9, and April 4 to December 31, determined from a fairly well defined rating curve.

Daily discharge, January 10 to April 3, estimated by means of numerous discharge measurements made during the period, climatological records and observer's notes.

Monthly discharge of Sacandaga River at Hadley, N. Y., Cable Station, for 1912.

[Drainage area 1,060 square miles.]

MONTH.	Maximum.				Minimum.	Mean.	Per square mile.	Run-off depth in inches.	Accuracy.
	Day.	Hour.	Gage height.	Discharge.					
			Feet.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.		
January	22	12 M.	5.44	a 3,140	d 580	1,070	1.01	1.16	B
February	12	4 P. M.	4.80	b 1,150	d 545	655	.618	.67	B
March	31	11:50 P. M.	6.92	c 6,900	d 518	2,130	2.01	2.32	B
April	9	10 A. M.	9.05	13,400	5,590	9,110	8.59	9.58	A
May	24	2 A. M.	6.61	6,150	2,050	3,710	3.50	4.04	A
June	1	12 A. M.	5.40	3,270	263	975	.920	1.03	A
July	24	10 A. M.	2.88	302	131	213	.201	.23	A
August	13	6 A. M.	2.88	302	95	191	.180	.21	A
September	26	10 P. M.	4.28	1,480	176	571	.539	.60	A
October	26	9 A. M.	6.41	5,620	486	1,570	1.48	1.71	A
November	9	10 P. M.	6.75	6,540	1,160	2,700	2.55	2.84	A
December	5	2 A. M.	6.15	4,960	1,110	2,360	2.23	2.57	A
The year	Apr. 9	10 A. M.	9.05	13,400	95	2,100	1.98	26.96	

a Occured January 1, 12:15 A. M. Open water.
b Occured February 23, 10 A. M. Ice conditions. Accuracy "D."
c Occured March 20, 10 A. M. Ice conditions. Accuracy "D."
d From ice curves. Accuracy "D."

West Branch Sacandaga River at Blackbridge, N. Y.

Location.— On the highway bridge known as Blackbridge, about 3 miles west of Wells and 2 miles above the junction of East and West branches of Sacandaga river. Replaces station formerly located at Whitehouse.

Records available.— March 14, 1911, to December 31, 1912. Data also in annual reports of United States Geological Survey.

Drainage area.— 211 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Chain, attached to upstream side of the highway bridge; read twice daily; datum unchanged.

Channel.— Rocky and permanent; two channels at extreme high water.

Discharge measurements.— Made from the bridge and by wading. Section beneath the bridge was cleared of boulders in September, 1911.

Artificial control.— Gage heights slightly affected by storage dams used for logging in the spring.

Winter flow.— Probably little affected by ice. Stream open during greater part of the winter.

Accuracy.— The open water rating curve is very well defined. Estimates for this period are good.

Discharge measurements of West Branch Sacandaga River at Blackbridge, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 4	C. S. DeGolyer	5.24	1,040
6	do	6.04	1,870
8	do	6.60	2,800
9	do	6.50	2,580
Aug. 7 *a*	J. G. Mathers	2.85	40.6
7 *a*	do	2.85	41.4
Sept. 13 *b*	G. H. Canfield	3.02	61.1

a Wading 20 feet below regular section.
b Wading at regular section.

Daily gage height, in feet, of West Branch Sacandaga River at Blackbridge, N. Y., for 1911.
[Cornelius De Groff, observer.]

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	4.85	6.6	4.4	3.7	2.94	3.55	3.7	4.35	4.75
2	......	4.7	7.5	4.1	3.7	2.9	3.26	3.8	4.45	4.65
3	......	4.55	6.3	4.05	3.65	2.85	3.47	3.9	4.4	4.45
4	......	4.6	6.2	3.8	3.6	2.89	3.32	4.4	4.25	4.35
5	......	4.6	6.1	4.3	3.55	2.84	3.2	4.65	4.35	4.85
6	......	4.85	5.6	4.05	3.5	3.75	3.9	4.5	4.15	4.25
7	......	5.7	5.05	4.5	3.5	3.42	3.95	4.3	4.55	4.1
8	......	5.7	5.25	4.35	3.5	3.06	4.15	3.11	5.2	4.1
9	......	5.35	4.45	4.05	3.48	3.31	4.3	4.5	5.15	4.2
10	......	5.25	......	4.1	3.44	3.16	4.3	4.55	5.15	4.5
11	......	5.1	4.15	4.0	3.4	2.99	4.25	4.45	5.05	4.75
12	......	5.3	4.2	3.85	3.38	2.96	4.0	4.25	5.1	5.8
13	......	5.5	4.55	4.7	3.36	3.85	3.9	4.1	5.25	6.4
14	3.85	6.0	4.85	5.45	3.32	3.75	3.85	3.15	5.15	5.6
15	4.9	6.1	4.4	4.85	3.27	3.65	3.9	4.45	6.5	5.8
16	5.3	6.1	4.4	4.85	3.42	3.48	3.8	3.8	4.55	5.6
17	5.4	6.0	5.6	4.55	3.46	3.35	3.65	3.75	6.2	5.6
18	4.65	5.9	4.65	4.4	3.4	2.95	3.5	4.5	5.1	5.6
19	4.6	5.9	4.8	4.25	3.23	2.86	......	4.25	5.4	5.25
20	4.45	5.8	5.2	4.05	3.18	2.99	......	5.2	5.15	5.2
21	4.15	6.0	4.75	3.85	3.08	2.94	......	5.2	5.05	4.95
22	3.95	5.9	4.8	3.8	2.95	2.88	......	......	4.55	4.75
23	4.25	5.8	5.2	3.75	3.08	2.82	3.14	5.7	4.35	6.8
24	4.15	5.8	5.0	3.65	3.26	2.78	3.08	5.4	4.7	5.6
25	4.1	5.7	5.05	3.6	3.4	2.74	3.1	4.35	4.55	5.45
26	3.95	6.4	5.0	3.55	3.22	2.82	3.1	5.1	4.25	5.5
27	4.75	6.7	4.3	3.6	3.14	2.9	3.1	5.05	4.25	5.6
28	5.7	7.4	4.1	3.75	3.08	3.14	3.1	4.65	4.25	4.65
29	5.4	7.4	4.1	3.6	3.02	4.15	3.6	4.5	4.65	4.95
30	4.9	7.1	4.1	3.7	2.96	3.9	3.8	4.3	4.8	4.75
31	5.05	......	4.15	......	2.98	3.65	......	3.9	......	4.95

Daily gage height, in feet, of West Branch Sacandaga River at Blackbridge, N. Y., for 1912.
[Cornelius De Groff, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.75	7.2	......	5.7	5.6	7.1	2.84	2.8	2.84	3.65	4.4	3.8
2.....	4.8	7.4	......	5.8	5.35	5.35	2.8	2.8	3.11	3.85	4.5	3.85
3.....	4.6	7.1	......	5.5	5.1	4.55	2.8	2.88	3.35	3.9	4.3	5.8
4.....	4.5	......	......	5.35	5.1	4.75	2.81	2.88	3.32	3.8	4.2	5.8
5.....	4.3	......	......	5.3	4.8	4.4	2.81	2.8	3.32	3.8	4.1	5.6
6.....	4.3	......	......	6.0	6.2	4.3	2.82	2.8	3.20	3.7	4.05	5.6
7.....	4.25	......	......	7.1	4.75	4.15	2.82	2.82	3.15	3.7	4.65	5.6
8.....	4.05	......	......	6.8	4.8	4.1	2.82	2.8	3.31	3.55	6.6	5.3
9.....	3.9	......	......	6.5	4.65	3.9	2.82	2.8	3.25	3.55	6.1	5.15
10.....	3.85	......	......	6.2	4.5	3.8	2.8	2.8	2.95	3.5	5.9	4.95
11.....	3.95	......	......	5.9	5.15	3.75	2.9	2.82	2.94	3.6	......	4.9
12.....	3.75	......	......	5.6	4.85	3.65	2.9	2.82	3.35	3.7	5.6	4.75
13.....	3.7	......	......	5.4	4.95	3.55	2.9	2.82	3.10	3.75	5.4	4.5
14.....	3.6	......	......	5.8	5.15	3.5	3.15	2.82	2.95	3.7	5.3	4.25
15.....	3.85	......	......	6.1	5.15	3.42	2.91	2.82	2.94	3.6	5.15	4.3
16.....	3.75	......	......	7.2	5.3	3.45	2.91	2.82	3.85	3.55	5.0	4.2
17.....	3.6	......	......	7.3	5.7	3.46	2.9	2.81	3.65	3.5	4.9	4.3
18.....	3.45	......	......	7.5	5.6	3.4	2.9	2.84	3.41	3.55	4.8	4.1
19.....	3.85	......	......	7.4	5.3	3.30	2.84	2.8	3.65	3.5	4.7	4.7
20.....	4.55	......	......	6.9	5.6	3.25	2.85	2.8	3.7	5.6	4.65	4.75
21.....	4.85	......	......	6.9	6.4	3.2	2.84	2.84	3.5	4.1	4.5	4.8
22.....	5.2	......	......	7.1	6.4	3.12	2.34	2.84	3.42	4.1	4.4	4.6
23.....	5.2	......	......	7.0	5.6	3.1	2.32	2.82	3.45	4.05	4.3	4.5
24.....	5.2	......	......	6.5	5.9	3.05	2.91	2.85	3.7	3.55	4.3	4.4
25.....	5.45	......	......	6.4	5.7	3.0	2.9	2.8	4.2	5.8	4.2	4.3
26.....	......	......	......	6.4	5.4	3.0	2.86	2.85	4.5	5.4	4.1	4.15
27.....	......	......	......	6.4	5.2	2.9	2.82	2.55	4.3	5.3	4.3	4.25
28.....	......	......	......	6.1	5.1	2.92	2.82	2.86	4.0	5.1	4.05	4.0
29.....	......	......	......	5.9	5.0	2.9	2.8	2.85	3.9	4.95	3.9	3.95
30.....	......	......	......	5.8	4.9	2.9	2.8	2.8	3.85	4.8	3.85	4.05
31.....	......	......	5.7	......	6.0	......	2.88	2.8	......	4.5	......	4.7

NOTE.— Relation of gage height to discharge affected by ice until some time in March, 1911, and January 20 to March 31, 1912.

Gage heights for May 10 and October 22, 1911, were evidently read wrong and consequently have been omitted.

Daily discharge, in second-feet, of West Branch Sacandaga River at Blackbridge, N. Y., for 1911.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	735	2,760	464	189	51	152	189	439	667
2	634	4,380	326	189	46	96	218	490	604
3	545	2,270	306	176	41	134	251	464	490
4	573	2,120	218	163	45	106	464	391	439
5	573	1,980	414	152	40	86	604	439	439
6	735	1,380	306	140	204	251	517	347	391
7	1,490	886	517	140	124	269	414	545	326
8	1,490	1,050	439	140	66	347	73	1,010	326
9	1,140	490	306	136	104	414	517	968	368
10	1,050	418	326	128	80	414	545	968	517
11	926	347	287	120	57	391	490	886	667
12	1,090	368	234	116	53	287	391	926	1,600
13	1,280	545	634	113	41	251	326	1,050	2,420
14	1,850	735	1,230	106	31	234	79	968	1,380
15	1,980	464	735	97	22	251	490	2,580	1,600
16	1,980	464	735	124	136	218	218	545	1,380
17	1,850	1,380	545	132	111	176	204	2,120	1,380
18	1,720	604	464	120	52	140	517	926	1,380
19	1,720	700	391	91	42	[120]	391	1,180	1,050
20	1,600	1,010	306	83	57	[105]	1,010	968	1,010
21	1,850	667	234	69	51	[92]	1,010	886	808
22	1,720	700	218	52	44	[84]	1,000	545	667
23	1,600	1,010	204	69	38	78	1,490	439	3,120
24	1,600	846	176	96	34	69	1,180	634	1,380
25	1,490	886	163	120	30	72	439	545	1,230
26	2,420	846	152	89	38	72	926	391	1,280
27	2,940	414	163	78	46	72	886	391	1,380
28	4,200	326	204	69	78	72	604	391	604
29	4,200	326	163	61	347	163	517	604	808
30	3,660	326	189	53	251	218	414	700	667
31	......	347	......	56	176	......	251	......	808

Daily discharge, in second-feet, of West Branch Sacandaga River at Blackbridge, N. Y., for 1912.

DAY.	Jan.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	667	1,490	1,380	3,660	40	36	40	176	464	218
2	700	1,600	1,140	1,140	36	36	73	234	517	234
3	573	1,280	926	545	36	44	111	251	414	1,600
4	517	1,140	926	667	37	44	106	218	368	1,600
5	414	1,090	700	464	37	36	106	218	326	1,380
6	414	1,850	2,120	414	38	36	86	189	306	1,380
7	391	3,660	667	347	38	38	79	189	604	1,380
8	306	3,120	700	326	38	36	104	152	2,760	1,090
9	251	2,580	604	251	38	36	94	152	1,980	968
10	234	2,120	517	218	36	36	52	140	1,720	808
11	269	1,720	968	204	46	38	51	163	1,550	770
12	204	1,380	735	176	46	38	111	189	1,380	667
13	189	1,180	808	152	46	38	72	204	1,180	517
14	163	1,600	886	140	79	38	52	189	1,090	391
15	234	1,980	886	124	47	38	51	163	968	414
16	204	3,840	1,090	130	47	38	234	152	846	368
17	163	4,020	1,490	132	46	37	176	140	770	414
18	130	4,380	1,380	120	46	40	122	152	700	326
19	234	4,200	1,090	102	40	36	176	140	634	634
20	......	3,300	1,380	94	41	36	189	1,380	604	667
21	......	3,300	2,420	86	40	40	140	326	517	700
22	......	3,660	2,420	75	5	40	124	326	464	573
23	......	3,480	1,380	72	4	38	130	306	414	517
24	......	2,580	1,720	65	47	41	189	152	414	464
25	......	2,420	1,490	58	46	36	368	1,600	368	414
26	......	2,420	1,180	58	42	41	517	1,180	326	347
27	......	2,420	1,010	46	38	15	414	1,090	414	391
28	......	1,980	926	48	38	42	287	926	306	287
29	......	1,720	846	46	36	41	251	808	251	269
30	......	1,600	770	46	36	36	234	700	234	306
31	......	......	1,850	......	44	36	......	517	......	634

NOTE.— Daily discharge determined from a well-defined rating curve. Discharge on days for which no gage heights are given, estimated from the discharge at Hope.

Monthly discharge of West Branch Sacandaga River at Blackbridge, N. Y., for 1911.
[Drainage area, 211 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Miniumm.	Mean.	Per square mile.	Depth in inches on drainage area.	
April	4,200	545	1,690	8.01	8.94	A
May	4,380	326	1,000	4.74	5.46	A
June	1,230	152	368	1.74	1.94	A
July	189	52	112	.531	.61	A
August	347	30	81.8	.388	.45	A
September	414	69	181	.858	.96	A
October	1,490	73	536	2.54	2.93	A
November	2,580	347	791	3.75	4.18	A
December	3,120	326	1,010	4.79	5.52	A

Monthly discharge of West Branch Sacandaga River at Blackbridge, N. Y., for 1912.
[Drainage area, 211 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Miniumm.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	250	1.18	1.36	D
February	....	....	130	.616	.66	D
March	....	....	400	1.90	2.19	D
April	4,380	1,090	2,440	11.6	12.94	A
May	2,420	517	1,170	5.55	6.40	A
June	3,660	46	334	1.58	1.76	A
July	79	4	39.8	.189	.22	A
August	44	15	37.5	.178	.21	A
September	517	40	158	.749	.84	A
October	1,600	140	410	1.94	2.24	A
November	2,760	234	763	3.62	4.04	A
December	1,600	218	669	3.17	3.66	A
The year	4,380	4	565	2.68	36.52	

NOTE.— Discharge January 20th to March 31st estimated by comparison with the discharge at Hadley.
Mean discharge January 20th–31st estimated 125 second-feet.

Miscellaneous measurements in Hudson River drainage basin in 1912.

DATE.	Stream.	Tributary to —	Locality.	Gage height.	Discharge.	Drainage area.	Discharge per square mile.
				Feet.	*Sec.-ft.*	*Sq. miles.*	*Sec.-ft.*
Mar. 11	Indian River	Hudson River	Below dam near Indian Lake, N. Y.	*8.27	522	131	4
12	Big Brook	Indian River	1 mile above mouth of brook, near Indian Lake, N. Y.	......	10.0	....	....

* Reference point to water surface: R. P. is X on top of lower chord eyebar, second panel from ighthand end of bridge, 2 feet from righthand end of bar. Gage at dam read 14.45. Discharge rom Big Brook = 10 second-feet; from other sources, including leakage through dam = 5 second-eet. Therefore discharge through gates = 507 second-feet, gate A being open 5 feet and B 3 feet.

CATTARAUGUS CREEK DRAINAGE BASIN.

Description.

Cattaraugus creek rises in the southwestern part of Wyoming county and flows in a westerly direction, entering Lake Erie about 25 miles southwest of Buffalo, on the boundary line between Erie and Chautauqua counties. The stream is about 55 miles in length and drains an area of approximately 560 square miles above the mouth. A large portion of its course forms the boundary between Erie and Chautauqua counties. Its head waters rise at an elevation of between 1,900 to 2,000 feet. The drainage basin is hilly, fairly well timbered and rather narrow. There are few tributary streams, those of most importance entering the river from the south.

South branch of Cattaraugus creek, which is the largest tributary, enters at a point about 2 miles above Gowanda. There is a dam at Gowanda which is used for developing electric power and also for running a local grist mill

and foundry. Formerly there was a development at Versailles, but a flood a few years ago washed the dam out and at present the developments at Gowanda are practically the only ones on the stream.

The average rain fall on the drainage basin is approximately 40 inches. A gaging station was established on this stream at Versailles, September 23, 1910.

Cattaraugus Creek at Versailles, N. Y.

Location.— On a 3-span highway bridge in the village of Versailles, about 6 miles below Gowanda, 2¼ miles above the mouth of Clear creek (coming in from the right), and about 8 miles above the mouth of the stream.

Records available.— September 23, 1910, to December 31, 1912. Data published also in annual reports of the United States Geological Survey and New York State Engineer and Surveyor.

Drainage area.— 467 square miles. (From post route map.)

Gage.— Chain, fastened to the upstream side of the first span from the right hand end of the bridge; read twice daily; datum unchanged.

Channel.— Rock and gravel; considered permanent.

Discharge measurements.— Made from downstream side of the bridge.

Winter flow.— Relation of gage height to discharge somewhat affected by ice.

Accuracy.— Discharge rating curve well defined, and data as published are good.

Discharge measurements of Cattaraugus Creek at Versailles, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 16 a	C. S. De Golyer	6.36	256
Mar. 26	G. H. Canfield	5.75	727
27	do	6.09	1,125
27	do	5.79	782
28	do	6.47	1,760
30	do	7.57	4,610
July 12	Frank Weber	5.20	279

a Measured under complete ice cover.

Daily gage height, in feet, of Cattaraugus Creek at Versailles, N. Y., for 1910.
[James A. Palmer, observer.]

DAY.	Sept.	Oct.	Nov.	Dec.	DAY.	Sept.	Oct.	Nov.	Dec.
1	......	5.05	6.45	6.45	17	......	5.02	6.1	5.6
2	......	4.95	6.55	6.4	18	......	5.05	6.0	5.6
3	......	4.9	6.15	6.15	19	......	5.02	5.98	5.82
4	......	5.05	5.78	5.95	20	......	5.02	5.9	5.8
5	......	5.01	5.6	5.9	21	......	5.0	5.82	5.72
6	......	5.2	5.6	5.68	22	......	5.62	5.8	5.62
7	......	6.15	5.7	5.7	23	5.05	5.75	5.85	5.7
8	......	5.55	5.72	5.65	24	5.01	5.4	6.7	5.72
9	......	5.28	5.78	5.6	25	5.09	5.48	6.95	5.7
10	......	5.22	7.7	5.72	26	5.05	5.85	6.55	5.75
11	......	5.18	7.3	5.7	27	5.05	5.55	6.2	5.7
12	......	5.12	6.5	5.64	28	5.05	6.4	6.2	5.7
13	......	5.08	6.3	5.55	29	5.05	6.3	6.7	7.0
14	......	5.08	6.25	5.65	30	5.05	6.2	6.4	7.3
15	......	5.08	6.2	5.6	31	......	6.1	......	6.4
16	......	5.08	6.2	5.45					

Daily gage height, in feet, of Cattaraugus Creek at Versailles, N. Y., for 1911.
[James A. Palmer, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.6	6.0	6.0	5.85	6.85	5.3	5.18	5.0	5.65	6.0	5.8	6.5
2	8.4	5.98	5.85	5.85	6.5	5.28	5.08	5.0	5.55	6.75	5.72	6.25
3	7.6	5.78	5.7	5.78	6.0	5.3	5.0	5.05	5.45	6.0	5.6	6.15
4	6.6	6.1	5.58	5.9	5.78	5.22	5.0	6.05	5.32	6.35	5.52	5.9
5	6.3	5.75	5.45	8.1	5.65	5.3	5.0	5.7	5.32	6.4	5.5	5.82
6	5.98	5.55	5.55	7.7	5.55	5.3	5.0	5.58	7.05	6.15	5.52	5.8
7	6.0	5.5	5.35	8.0	5.52	5.22	5.22	5.25	7.2	5.95	6.0	5.82
8	6.0	5.68	5.55	6.6	5.48	5.2	5.08	5.72	7.7	5.88	6.5	5.98
9	6.3	5.75	5.62	6.4	5.42	5.22	5.05	5.35	6.15	5.85	5.9	6.25
10	8.4	5.65	6.8	6.3	5.42	5.2	5.1	5.3	5.78	5.75	5.68	6.65
11	8.4	5.5	6.3	6.2	5.48	5.2	5.12	5.15	5.7	5.7	5.7	6.5
12	7.7	5.5	7.4	6.15	5.22	5.2	5.08	5.1	5.62	5.72	5.85	6.55
13	7.2	5.5	6.5	5.95	5.0	5.2	5.0	5.1	5.65	5.62	6.1	7.96
14	7.1	5.65	6.8	6.0	5.42	5.2	5.0	5.1	5.6	5.52	6.1	7.0
15	7.35	6.25	6.9	6.15	5.38	5.18	4.95	5.05	5.6	5.52	6.15	7.1
16	6.35	6.1	6.5	5.95	5.38	5.12	4.95	5.55	5.6	5.55	6.1	6.75
17	6.05	8.0	6.3	5.98	5.32	5.1	5.0	5.35	5.40	5.52	6.0	6.65
18	5.88	7.8	6.0	5.45	5.35	5.1	5.3	5.25	5.42	5.62	8.4	6.45
19	5.92	7.0	5.8	5.8	5.68	5.1	5.08	5.15	5.4	5.6	6.7	6.1
20	5.92	6.4	5.92	6.0	6.1	5.1	5.3	5.05	5.4	5.6	6.5	5.85
21	6.1	6.3	6.0	5.98	5.4	5.05	5.22	5.0	5.32	5.52	6.4	5.88
22	6.1	5.98	6.55	6.0	5.32	5.0	5.18	5.1	5.32	5.42	6.25	5.98
23	6.0	5.78	6.8	5.85	5.3	5.15	5.18	5.12	5.32	5.62	6.2	6.9
24	5.6	5.8	6.0	5.82	5.32	5.15	5.1	5.12	5.22	5.65	6.75	6.2
25	5.7	5.82	5.82	5.68	5.35	5.1	5.1	5.3	5.48	5.6	6.45	6.05
26	5.75	6.15	6.3	5.62	5.32	5.12	5.15	5.35	5.38	5.62	6.25	6.0
27	6.2	6.7	7.55	5.55	5.22	5.38	5.1	5.45	5.3	5.58	6.1	6.4
28	7.9	6.1	7.15	5.55	5.28	5.65	5.1	6.85	5.32	5.6	6.1	5.92
29	6.65	......	6.4	5.5	5.25	5.45	5.12	7.5	5.3	5.48	7.05	6.45
30	6.25	......	6.3	5.62	5.22	5.22	5.1	6.2	5.38	5.4	6.7	6.05
31	6.0	......	6.1	......	5.22	......	5.0	5.75	......	5.48	......	6.0

Daily gage height, in feet, of Cattaraugus Creek at Versailles, N. Y., for 1912.

[James A. Palmer, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.3	6.95	7.35	8.9	6.35	5.25	4.9	5.1	7.7	5.65	5.08	5.58
2	6.1	7.0	7.15	8.5	5.95	5.22	4.88	5.02	6.6	5.42	5.0	7.15
3	5.85	6.85	7.1	6.95	5.85	5.45	4.92	5.12	5.7	5.28	5.45	7.2
4	5.63	6.85	7.1	6.7	5.75	5.25	5.25	5.1	5.38	5.18	5.48	6.4
5	5.5	6.85	7.0	7.4	5.7	5.22	5.32	5.05	5.3	5.1	5.45	5.95
6	5.47	6.85	7.05	8.0	5.78	5.12	5.12	4.92	5.22	5.12	5.42	7.25
7	5.43	6.85	7.0	8.3	6.3	5.12	5.1	4.9	5.2	5.08	5.6	6.3
8	5.47	6.85	6.9	7.1	6.15	5.12	4.95	4.98	5.12	5.05	6.15	6.05
9	5.97	6.85	7.0	6.5	5.95	5.1	4.95	4.92	5.05	5.08	5.9	5.85
10	6.45	6.85	6.9	5.9	5.75	5.08	4.9	4.98	5.0	5.15	6.05	5.48
11	6.85	6.8	6.9	5.9	5.65	5.08	5.38	5.02	5.08	5.28	5.75	5.58
12	6.9	6.75	6.95	6.8	5.45	5.08	5.25	4.98	5.12	5.15	5.58	5.35
13	6.8	6.7	6.1	6.65	5.65	5.05	5.15	5.08	5.12	5.12	5.48	5.15
14	6.85	6.65	6.9	6.4	5.78	5.05	5.25	5.08	5.02	5.12	5.65	5.68
15	6.85	6.6	7.15	6.3	5.72	5.05	5.1	5.05	5.02	5.05	5.52	5.62
16	6.8	6.6	7.2	7.1	5.88	5.08	5.45	5.88	5.22	5.02	5.52	5.62
17	7.0	6.6	7.5	6.55	6.05	5.22	5.15	5.92	5.32	5.08	5.52	5.7
18	7.2	6.65	8.0	6.0	5.85	5.12	5.02	5.92	5.3	5.05	5.48	5.9
19	7.35	6.6	7.9	5.95	5.65	5.08	5.02	5.02	5.32	5.02	5.42	6.2
20	7.45	6.75	7.8	5.92	5.58	5.05	5.05	5.08	5.2	5.08	5.5	5.75
21	......	6.9	6.75	5.95	5.58	4.98	5.25	4.95	5.05	5.02	5.42	5.58
22	......	6.8	6.35	6.0	5.52	5.0	5.12	4.92	5.08	5.18	5.45	5.42
23	......	6.7	6.05	6.3	5.45	5.02	5.02	5.05	5.15	7.4	5.38	5.32
24	......	6.8	6.05	6.1	5.42	5.05	4.98	5.08	5.38	6.25	5.35	5.25
25	......	7.0	5.9	6.1	5.32	5.02	5.02	4.98	5.25	6.45	5.38	5.22
26	......	7.2	5.7	6.05	5.32	5.05	5.08	5.08	5.12	6.15	5.4	5.12
27	......	7.8	6.05	6.0	5.28	5.02	5.08	5.32	5.02	5.75	5.48	5.18
28	7.05	7.7	6.5	5.8	5.2	5.02	5.0	5.38	5.02	5.55	5.48	5.22
29	7.15	7.6	8.8	7.35	5.25	5.02	4.98	5.35	5.02	5.35	5.52	5.32
30	7.05	......	7.5	7.0	5.22	4.95	5.0	5.12	5.02	5.32	5.58	6.95
31	6.95	......	7.4	......	5.38	......	5.02	6.1	......	5.22	......	6.45

NOTE.— Relation of gage height to discharge affected by ice January 8 to March 14, 1912. Ice jams are known to have existed, January 1 to 5, and January 10 to 12, 1911, and there may have been ice jams at other times during January, February, and March, 1911.

Daily discharge, in second-feet, of Cattaraugus Creek at Versailles, N. Y., for 1910.

DAY.	Sept.	Oct.	Nov.	Dec.	DAY.	Sept.	Oct.	Nov.	Dec.
1	......	166	1,720	1,720	17	......	149	1,160	586
2	......	111	1,920	1,630	18	......	166	1,030	586
3	......	85	1,230	1,230	19	......	149	1,010	817
4	......	166	772	968	20	......	149	907	794
5	......	143	586	907	21	......	137	817	708
6	......	257	586	666	22	......	606	794	606
7	......	1,230	686	686	23	166	740	850	686
8	......	539	708	636	24	143	405	2,230	708
9	......	313	772	586	25	189	475	2,820	686
10	......	271	5,060	708	26	166	850	1,920	740
11	......	245	3,780	686	27	166	539	1,300	686
12	......	207	1,820	626	28	166	1,630	1,300	686
13	......	183	1,460	539	29	166	1,460	2,230	2,940
14	......	183	1,380	636	30	166	1,300	1,630	3,780
15	......	183	1,300	586	31	......	1,160	......	1,630
16	......	183	1,300	448					

Daily discharge, in second-feet, of Cattaraugus Creek at Versailles, N. Y., for 1911.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1,820	1,030	1,030	850	2,570	327	245	137	636	1,030	794	1,820
2.....	6,190	1,010	850	850	1,820	313	183	137	539	2,340	708	1,380
3.....	4,250	772	686	772	1,030	327	137	166	448	1,030	586	1,230
4.....	1,820	1,160	567	907	772	271	137	1,100	343	1,540	511	907
5.....	1,310	740	448	6,460	636	327	137	686	343	1,630	492	817
6.....	1,010	539	539	5,060	539	327	137	567	3,070	1,230	511	794
7.....	1,030	492	366	6,100	511	271	271	292	3,480	968	1,030	817
8.....	1,030	666	539	2,020	475	257	183	708	5,060	884	1,820	1,010
9.....	1,460	740	606	1,630	422	271	166	366	1,230	850	907	1,380
10.....	6,790	636	2,450	1,460	422	257	195	327	772	740	666	2,120
11.....	6,790	492	1,460	1,300	475	257	207	226	686	686	686	1,820
12.....	4,550	492	4,080	1,230	271	257	183	195	606	708	850	1,920
13.....	3,480	492	1,820	968	137	257	137	195	636	606	1,160	5,960
14.....	3,200	636	2,450	1,030	422	257	137	195	586	511	1,160	2,940
15.....	3,930	1,380	2,690	1,230	389	245	111	166	586	511	1,230	3,200
16.....	1,540	1,160	1,820	968	389	207	111	539	586	539	1,160	2,340
17.....	1,100	6,100	1,460	1,010	343	195	137	366	405	539	1,030	2,120
18.....	884	5,400	1,030	448	366	195	327	292	422	606	7,540	1,720
19.....	932	2,940	794	794	666	195	183	226	405	586	2,230	1,160
20.....	932	1,630	932	1,030	1,160	195	327	166	405	586	1,820	850
21.....	1,160	1,460	1,030	1,010	405	166	271	137	343	539	1,630	884
22.....	1,160	1,010	1,920	1,030	343	137	245	195	343	422	1,380	1,010
23.....	1,030	772	2,450	850	327	226	245	207	343	606	1,300	2,690
24.....	586	794	1,030	817	343	226	195	207	271	636	2,340	1,300
25.....	686	817	817	666	366	195	195	327	475	586	1,720	1,100
26.....	740	1,230	1,460	606	343	207	226	366	389	606	1,380	1,030
27.....	1,300	2,230	4,560	539	271	389	195	448	327	567	1,160	1,630
28.....	5,740	1,160	3,340	539	313	636	195	2,570	343	586	1,160	932
29.....	2,120	......	1,630	492	292	448	207	4,400	327	475	3,070	1,720
30.....	1,380	......	1,460	606	271	271	195	1,300	389	405	2,230	1,100
31.....	1,030	......	1,160	......	271	......	137	740	......	475	......	1,030

Daily discharge, in second-feet, of Cattaraugus Creek at Versailles, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1,460	......	......	9,340	1,540	292	85	195	5,060	636	183	567
2.....	1,160	......	......	7,900	968	271	75	149	2,020	422	137	3,340
3.....	850	......	......	2,820	850	448	95	207	686	313	448	3,480
4.....	616	......	......	2,230	740	292	292	195	389	245	475	1,630
5.....	492	......	......	4,080	686	271	343	166	327	195	448	968
6.....	466	......	......	6,100	772	207	207	95	271	207	422	3,630
7.....	431	......	......	7,180	1,460	207	195	85	257	183	586	1,460
8.....	......	......	......	3,200	1,230	207	111	127	207	166	1,230	1,100
9.....	......	......	......	1,820	968	195	111	95	166	183	907	850
10.....	......	......	......	907	740	183	85	127	137	226	1,100	475
11.....	......	......	......	907	636	183	389	149	183	313	740	567
12.....	......	......	......	2,450	448	183	292	127	207	226	567	366
13.....	......	......	......	2,120	636	166	226	183	207	207	475	226
14.....	......	......	......	1,630	772	166	292	183	149	207	636	666
15.....	......	......	3,340	1,460	708	166	195	166	149	166	511	606
16.....	......	......	3,480	3,200	884	183	448	884	271	149	511	606
17.....	......	......	4,400	1,920	1,100	271	226	932	343	183	511	686
18.....	......	......	6,100	1,030	850	207	149	932	327	166	475	907
19.....	......	......	5,740	968	636	183	149	149	343	149	422	1,300
20.....	......	......	5,400	932	567	166	166	183	257	183	492	740
21.....	......	......	2,340	968	567	127	292	111	166	149	422	567
22.....	......	......	1,540	1,030	511	137	207	95	183	245	448	422
23.....	......	......	1,100	1,460	448	149	149	166	226	4,080	389	343
24.....	......	......	1,100	1,160	422	166	127	183	389	1,380	366	292
25.....	......	......	907	1,160	343	149	149	127	292	1,720	389	271
26.....	......	......	686	1,100	343	166	183	183	207	1,230	405	207
27.....	......	......	1,100	1,030	313	149	183	343	149	740	475	245
28.....	......	......	1,820	794	257	149	137	389	149	539	475	271
29.....	......	......	8,980	3,930	292	149	127	366	149	366	511	342
30.....	......	......	4,400	2,940	271	111	137	207	149	343	567	2,820
31.....	......	......	4,080	......	389	......	149	1,160	......	271	......	1,720

NOTE.— Daily discharge determined from a rating curve well defined below 2,000 second-feet. Daily discharge January 1 to 5 and 10 to 12, 1911, reduced somewhat on account of ice jams Daily discharge for other short periods during 1911 may be in error because of ice jams.

LITTLE TONAWANDA CREEK AT LINDEN, N. Y. Fig. G.
Looking downstream at weir. Gage near right bank.

Monthly discharge of Cattaraugus River at Versailles, N. Y., for 1910.
[Drainage area, 467 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
September, 23–30	189	143	166	.356	.11	A
October	1,630	85	464	.994	1.15	A
November	5,060	586	1,500	3.21	3.58	A
December	3,780	448	964	2.06	2.38	C

Monthly discharge of Cattaraugus River at Versailles, N. Y., for 1911.
[Drainage area, 467 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	1,870	4.00	4.61	D
February	6,100	492	1,360	2.91	3.03	C
March	4,560	366	1,530	3.28	3.78	B
April	6,460	448	1,440	3.08	3.44	A
May	2,570	137	560	1.20	1.38	A
June	636	137	270	.578	.64	A
July	327	111	189	.405	.47	A
August	4,400	137	579	1.24	1.43	A
September	5,060	271	826	1.77	1.98	A
October	2,340	405	775	1.66	1.91	A
November	7,540	492	1,480	3.17	3.54	A
December	5,920	794	1,640	3.51	4.05	A
The year	7,540	111	1,040	2.23	30.26	

Monthly discharge of Cattaraugus Creek at Versailles, N. Y., for 1912.
[Drainage area, 467 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	470	1.01	1.16	D
February	....	....	290	.621	.67	D
March	8,980	....	2,050	4.39	5.06	C
April	9,340	794	2,590	5.55	6.19	A
May	1,540	257	689	1.48	1.71	A
June	448	111	197	.422	.47	A
July	448	75	193	.413	.48	A
August	1,160	85	279	.597	.69	A
September	5,060	137	467	1.00	1.12	A
October	4,080	149	509	1.09	1.26	A
November	1,100	137	524	1.12	1.25	A
December	3,630	207	1,020	2.18	2.51	A
The year	9,340	75	747	1.60	22.57	

NOTE.— Discharge January 8 to March 14, 1912, estimated by means of comparison with adjacent stations.
Mean discharge January 8–31 estimated 380 second-feet.
Mean discharge March 1–14 estimated 500 second-feet.

TONAWANDA CREEK DRAINAGE BASIN.

Tonawanda creek rises in Wyoming county and flows northerly into Genesee county. At Batavia it turns abruptly to the west and continues in that direction until it reaches the Niagara river at Tonawanda. After passing out of Genesee county, it forms the boundary between Niagara county and Erie county. Tonawanda creek rises in a rather hilly country and, in the upper part of the drainage, flows through a rather narrow valley.

Its main tributary is Little Tonawanda creek which flows into the stream from the right about 3 miles south of Batavia. There is a good storage reservoir site for a capacity of 9,100,000,000 gallons on this stream at Linden which is being investigated by the State of New York Conservation Commission, with a view to installing a water supply for the Orleans Water Supply District, including Batavia, Tonawandas, Brockport, Albion, Middleport and 56 other towns and villages in Genesee, Orleans and Monroe counties. The Conservation Commission has issued a pamphlet descriptive of this project, free copies of which may be obtained by writing to this Commission at Albany.

Little Tonawanda Creek at Linden, N. Y.

Location.— At the stone arch highway bridge in the village of Linden, 600 feet northeast of the Erie railroad station and 3 miles above the junction with Tonawanda creek.

Records available.— July 8 to December 31, 1912.

Drainage area.— 22.0 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Vertical staff on the right hand upstream abutment of the bridge, lower 2 feet of enameled iron gage graduated to hundredths of a foot, upper 4 feet of bronze graduated to half tenths. An auxiliary bronze gage is fastened to the right hand downstream abutment of the bridge and used as a check on rating the upper gage. (See Fig. G.)

Channel.— A standard Francis weir has been constructed under the upstream side of the bridge, having a length of 2.01 feet and a height of 8 inches. (See Fig. H.) When the stage gets above the depth of this weir, it flows over a 2-inch plank about 13 feet long, including the 2 feet of weir.

Discharge measurements.— Are made from a cable and car 1,000 feet upstream during high water and by wading above the weir at low water.

Accuracy.— When the gage height is at 0.69 or below, the flow is confined to the weir. During such periods the accuracy of the data will be the accuracy of any Francis weir. Above gage height 0.69 the weir has been rated with a current meter and the accuracy of the data so obtained should also be excellent.

LITTLE TONAWANDA CREEK AT LINDEN, N. Y.
Looking upstream at weir under bridge.

Fig. H.

Discharge measurements of Little Tonawanda Creek at Linden, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 8	Frank Weber	*a*	1.14
Oct. 3	J. G. Mathers	.38	1.31
3	do	.38	1.40
3	do	.38	1.37
Dec. 5	C. S. DeGolyer	1.14	17.9
5	do	1.11	16.5
7	do	1.22	24.9

a Gage not installed.

Daily gage height, in feet, of Little Tonawanda Creek at Linden, N. Y., for 1912.
[C. L. Schenck, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.34	0.51	0.38	0.52	0.83	17	0.39	0.24	0.34	0.3	0.84	0.86
2	.....	.35	.69	.41	.5	1.43	18	.36	.38	.37	.3	.82	.9
3	.....	.38	.65	.4	.5	1.79	19	.35	.33	.4	.32	.8	1.0
4	.....	.34	.55	.39	.46	1.3	20	.34	.32	.5	.3	.8	.87
5	.....	.32	.48	.35	.45	1.14	21	.37	.36	.4	.3	.76	.88
6	.....	.31	.44	.33	.44	1.44	22	.4	1.4	.36	.28	.74	.86
7	.....	.3	.4	.32	.52	1.2	23	.36	.92	.4	.42	.72	.86
8	.....	.3	.38	.31	.9	1.02	24	.34	.96	.46	.69	.72	.88
9	.....	.3	.38	.31	.98	.92	25	.33	.79	.52	.86	.82	.87
10	0.44	.3	.34	.34	.9	1.02	26	.33	.72	.43	.84	.78	.86
11	.39	.3	.34	.34	.82	.94	27	.3	.7	.39	.78	.84	.89
12	.36	.3	.34	.32	.78	.88	28	.3	.62	.38	.72	.8	.8
13	.35	.28	.32	.32	.75	.84	29	.46	.58	.36	.66	.84	.88
14	.54	.28	.31	.31	.95	.82	30	.35	.52	.36	.6	.85	.94
15	.39	.26	.32	.31	.88	.83	31	.34	.47	.....	.54	.....	1.29
16	.48	.24	.39	.3	.88	.84							

NOTE.— To reduce gage heights to heads on the weir, substract .03 foot.

Daily discharge, in second-feet, of Little Tonawanda Creek at Linden, N. Y., for 1912.

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.12	2.12	1.34	2.18	6.3	17	1.39	.63	1 12	.91	6.6	7.2
2	.....	1.17	3.36	1.51	2.05	33.8	18	1.23	1.34	1.28	.91	6.0	8.4
3	.....	1.34	3.07	1.45	2.05	58.1	19	1.17	1.07	1.45	1.01	5.5	12.0
4	.....	1.12	2.38	1.39	1.81	26.0	20	1.12	1.01	2.05	.91	5.5	7.5
5	.....	1.01	1.93	1.17	1.74	17.8	21	1.28	1.23	1.45	.91	4.6	7.8
6	.....	.96	1.68	1.07	1.68	34.4	22	1.45	32.0	1.23	.82	4.2	7.2
7	.....	.91	1.45	1.01	2.18	20.6	23	1.23	9.1	1.45	1.56	3.8	7.2
8	1.14	.91	1.34	.96	8.4	12.8	24	1.12	10.5	1.81	3.36	3.8	7.8
9	.....	.91	1.34	.96	11.2	9.1	25	1.07	5.2	2.18	7.2	6.0	7.5
10	1.68	.91	1.12	1.12	8.4	12.8	26	1.07	3.8	1.62	6.6	5.0	7.2
11	1.39	.91	1.12	1.12	6.0	9.8	27	.91	3.48	1.39	5.0	6.6	8.1
12	1.23	.91	1.12	1.01	5.0	7.8	28	.91	2.86	1.34	3.8	5.5	5.5
13	1.17	.82	1.01	1.01	4.4	6.6	29	1.81	2.58	1.23	3.14	6.6	7.8
14	2.32	.82	.96	.96	10.1	6.0	30	1.17	2.18	1.23	2.72	6.9	9.8
15	1.39	.72	1.01	.96	7.8	6.3	31	1.12	1.87	.....	2.32	.....	25.4
16	1.93	.63	1.39	.91	7.8	6.6							

NOTE.— Daily discharge determined from a rating curve based on the Francis weir formula Above gage height .69 foot the entire length of the wooden dam is considered as a weir. The discharge measurements that have been made check the curve quite closely.

Monthly discharge of Little Tonawanda Creek at Linden, N. Y., for 1912.
[Drainage area, 22.0 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Millions of gallons.
July, 10–31	2.32	.91	1.33	.060	.05	18.9
August	35.0	.63	3.09	.140	.16	61.8
September	3.36	.96	1.57	.071	.08	30.4
October	7.2	.82	1.91	.087	.10	38.3
November	11.2	1.68	5.31	.241	.27	103.0
December	66.2	5.5	13.8	.627	.72	277.2

GENESEE RIVER DRAINAGE BASIN.

Description.

Genesee river rises in Potter county, Pa., 8 or 10 miles south of the New York-Pennsylvania boundary, flows northwestward for about 32 miles by general course, then turns to the northeast, and empties into Lake Ontario, 7 miles north of Rochester. The entire length of the stream, following bends, is about 135 miles, and the drainage area is about 2,450 square miles.

In the 39 miles between Belmont, in central Allegheny county, and Portage, in southwestern Livingston county, the fall of the water-surface is 253 feet, an average of 6.4 feet per mile. At Portage the river plunges down in three magnificent falls, and thence nearly to Mount Morris flows at the bottom of a deep gorge. From Mount Morris to Rochester the valley is broad and open and the stream is bordered by meadows subject to occasional overflow. At Rochester there is another abrupt descent over three heavy falls, amounting to about 260 feet within the city.

In the northern counties the surface is rolling, with long, easy slopes, except along the streams, which usually lie in deep ravines, hemmed in by steep banks. On the whole there is a gradual rise away from the lakes, and in the upper half of the basin the country becomes rough and is broken by ridges, the summits of which attain elevations of from 2,000 to 2,500 feet above tide.

Precipitation is rather low, the average rainfall being about 35 inches, some 14 inches smaller than that of the upper Sacandaga. Possibilities for storage are great and the State of New York Conservation Commission proposes a high concrete dam, in the vicinity of Portage, which will store about 19,000,000,000 cubic feet of water, 13,400,000,000 cubic feet of which will be available for commercial purposes. This dam would have a water surface of about 13½ square miles. Such a reservoir would control a flow equal to the greatest recorded, that of 1865. In addition to this high degree of river control the reservoir could be used to develop electric horsepower at Portgage to the extent of 75,000 horsepower, peak load, and at the same time allow the mills at Rochester to run the entire year.

GENESEE RIVER AT ST. HELENA, N. Y. Fig. I.
Gurley automatic water stage register and concrete shelter.

Genesee River at St. Helena, N. Y.

Location.— At the steel highway bridge about 6 miles above the mouth of Silver Lake outlet (coming in from the left), 9⅛ miles above Canaseraga creek (coming in from the right), and 5½ miles below the village of Portageville and the site of the proposed storage dam of the State of New York Conservation Commission.

Records available.— August 14, 1908, to December 31, 1912. Published also in annual reports of the State Water Supply Commission of New York, 1910, report of the New York State Engineer and Surveyor and the United States Geological Survey.

Drainage area.— 1,030 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Chain, fastened to the upstream side of the bridge, middle span; read twice daily. Datum unchanged. Since August 24, 1911, a Gurley self-recording gage with intake pipe to a well a few feet downstream from the chain gage. Datum same as chain gage, but readings different, due to slope of water surface. (See Fig. I.)

Channel.— Gravel and rocks; considered permanent.

Discharge measurements.— At high stages made from the bridge, at low stages by wading near the bridge.

Winter flow.— Relation between gage height and discharge usually but slightly affected by ice; determination of winter discharge considered good.

Accuracy.— Discharge rating curve well defined, and data as published considered excellent.

Discharge measurements of Genesee River at St. Helena, N. Y., in 1912.

DATE.	Hydrographer.	GAGE HEIGHT.		Discharge.
		Chain.	Recording.	
		Feet.	*Feet.*	*Sec.-ft.*
Jan. 4 *a*	C. S. De Golyer	2.78	2.72	502
4	do	2.63	2.58	480
Feb. 17 *b*	do	3.32	3.29	211
Mar. 10 *b*	G. H. Canfield	4.54	4.47	740
22	do	4.44	4.38	2,470
22	do	4.41	4.31	2,440
June 16 *c*	Frank Weber	2.02	2.01	196
Oct. 25	C. S. De Golyer	3.34	3.24	954
25	do	3.52	3.40	1,130
29 *c*	do	2.84	2.77	552

a Some slush ice and ice near shore.
b Measure made under complete ice cover.
c Measure made by wading.

Daily gage height, in feet, by automatic and chain gages, of Genesee River at St. Helena, N. Y., for 1912.

DAY.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1......	c3.2	3.2	3.34	2.6	4.5	4.9	8.55	8.6	4.75	5.0	2.56	2.6
2......	c3.0	3.0	3.33	2.7	4.28	4.6	8.13	8.6	4.14	4.2	2.46	2.5
3......	c2.9	2.9	3.32	2.65	4.14	4.4	6.54	6.4	3.82	3.9	2.53	2.55
4......	2.71	2.65	3.29	2.6	4.05	4.3	5.38	5.4	3.58	3.7	2.72	2.8
5......	2.57	2.55	3.3	2.5	3.90	4.2	6.3	6.6	3.38	3.45	2.48	2.55
6......	2.39	2.46	3.31	2.45	3.93	4.2	7.62	7.4	3.34	3.4	2.38	2.48
7......	2.47	2.7	3.26	2.5	3.89	4.2	7.39	7.4	3.4	3.55	2.33	2.44
8......	2.8	2.75	3.25	2.45	3.93	4.2	6.8	6.9	3.26	3.4	2.28	2.39
9......	2.82	2.46	3.28	2.5	4.05	4.2	5.36	5.4	3.12	3.15	2.21	2.24
10......	2.7	2.65	3.28	2.45	4.45	4.6	5.28	5.4	3.11	3.2	2.2	2.2
11......	2.74	2.8	3.26	2.4	4.48	4.5	4.67	4.7	3.02	3.1	2.13	2.1
12......	2.83	2.9	c2.5	2.5	4.33	4.4	4.64	4.7	2.86	2.95	2.12	2.08
13......	2.85	2.8	c2.8	2.8	4.27	4.3	5.54	5.6	3.04	3.1	1.99	2.04
14......	2.85	2.7	c2.85	2.85	4.18	4.2	4.77	4.8	3.16	3.25	2.1	2.16
15......	2.89	2.8	c3.0	3.0	4.22	4.2	4.96	5.7	3.07	3.1	2.06	2.14
16......	3.23	2.9	c2.7	2.7	5.92	5.9	4.05	5.0	3.79	3.7	2.04	2.16
17......	3.42	2.85	c3.25	3.25	6.32	6.5	4.37	4.4	5.74	5.9	2.09	2.11
18......	3.37	2.9	3.31	3.15	7.17	7.3	4.09	4.2	4.56	4.7	2.06	2.08
19......	3.49	3.0	3.35	3.35	7.11	7.0	3.99	4.1	3.95	4.0	2.04	2.09
20......	4.41	4.2	3.49	3.3	7.26	7.3	3.78	3.85	3.65	3.25	2.0	2.02
21......	4.36	4.1	3.67	3.4	5.38	5.4	3.58	3.65	3.42	3.5	2.05	2.04
22......	4.1	3.2	4.17	4.3	4.39	4.4	3.48	3.55	3.38	3.55	2.0	2.04
23......	3.98	2.8	4.15	4.2	4.08	4.1	3.87	3.9	3.35	3.45	1.75	1.94
24......	3.86	3.5	4.2	4.3	3.93	4.2	3.9	4.0	3.06	3.2	1.99	2.02
25......	3.71	3.0	4.42	4.5	3.6	3.55	3.73	3.8	2.88	3.0	1.97	2.01
26......	3.61	2.8	4.45	4.6	3.38	3.4	3.44	3.55	2.76	2.8	1.96	2.0
27......	3.54	2.7	4.72	4.8	3.41	3.55	3.26	3.4	2.67	2.7	1.75	1.66
28......	3.46	2.65	4.95	5.1	4.2	4.7	3.14	3.2	2.57	2.65	1.75	1.74
29......	3.4	2.6	4.82	5.0	7.95	8.9	4.5	4.6	2.54	2.6	1.83	1.71
30......	3.4	2.7	......	......	8.35	8.2	6.5	6.5	2.57	2.6	1.7	1.71
31......	3.36	2.5	......	......	7.24	6.9	......	......	2.73	2.8	......	......

DAY.	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1......	1.74	1.61	1.68	1.65	2.2	2.16	3.37	2.9	2.45	2.5	2.53	2.6
2......	1.79	1.76	1.85	1.85	3.4	3.8	4.0	4.0	2.52	2.55	2.78	2.75
3......	1.82	1.72	1.88	1.82	3.45	3.5	3.26	3.3	2.61	2.7	5.42	5.6
4......	1.51	1.2	1.88	1.78	3.05	3.1	2.94	3.0	2.53	2.55	4.2	4.3
5......	1.79	1.82	2.02	2.09	2.67	2.75	2.78	2.8	2.46	2.49	3.71	3.9
6......	1.77	1.74	1.95	2.08	2.5	2.5	2.62	2.65	2.39	2.46	4.84	5.6
7......	1.52	1.46	1.86	1.89	2.54	2.6	2.52	2.55	2.5	2.46	4.42	4.5
8......	1.85	1.8	1.78	1.79	2.35	2.42	2.42	2.44	4.56	4.9	3.69	3.8
9......	1.76	1.79	1.76	1.86	2.25	2.21	2.38	2.44	4.03	4.4	3.17	3.2
10......	1.6	1.58	1.75	1.72	2.16	2.24	2.41	2.5	4.19	4.4	3.05	3.1
11......	2.01	1.85	1.52	1.52	2.07	2.1	2.83	2.8	3.71	3.9	3.1	3.25
12......	2.18	2.21	1.7	1.75	2.0	2.04	2.94	3.0	3.39	3.45	2.84	2.9
13......	2.16	2.22	1.83	1.86	2.07	2.12	2.66	2.7	3.18	3.3	2.55	2.65
14......	2.06	2.09	1.99	2.09	1.87	1.85	2.56	2.6	3.12	3.3	2.63	2.65
15......	2.05	2.08	1.87	1.84	1.82	2.14	2.41	2.5	3.08	3.25	2.7	2.7
16......	c2.02	2.02	1.79	1.71	2.41	2.21	2.31	2.35	2.96	3.05	2.77	2.75
17......	c1.84	1.84	1.72	1.65	3.06	3.1	2.26	2.29	2.86	2.9	2.73	2.75
18......	1.91	1.88	1.56	1.54	2.68	2.75	2.21	2.29	2.83	2.9	2.76	2.8
19......	1.86	1.82	1.91	1.96	2.58	2.65	2.2	2.31	2.78	2.9	2.94	3.05
20......	1.75	1.78	1.83	1.82	2.56	2.6	2.16	2.22	2.76	2.9	3.02	3.2
21......	1.57	1.54	1.84	1.85	2.44	2.48	c2.24	2.24	2.74	2.8	2.83	2.9
22......	2.01	2.09	1.83	1.92	2.29	2.34	c2.16	2.16	2.65	2.7	2.7	2.7
23......	1.82	1.82	1.84	1.85	2.26	2.32	c3.05	3.05	2.57	2.6	2.63	2.7
24......	1.82	1.85	1.83	1.84	2.3	2.36	c3.8	3.8	2.52	2.6	2.63	2.65
25......	1.73	1.68	1.75	1.78	3.03	3.15	3.38	3.4	2.59	2.7	2.6	2.6
26......	1.85	1.81	2.02	2.0	3.21	3.35	3.59	3.65	2.64	2.7	2.55	2.65
27......	2.03	2.09	2.48	2.95	2.99	2.95	3.22	3.3	2.66	2.8	2.54	2.55
28......	1.88	1.8	2.85	2.9	3.04	3.15	2.91	3.0	2.65	2.7	2.4	2.45
29......	2.03	2.04	2.45	2.49	2.75	2.8	2.74	2.85	2.6	2.7	2.24	2.18
30......	1.91	1.91	2.29	2.35	2.86	3.0	2.6	2.8	2.58	2.7	2.65	2.7
31......	1.78	1.81	2.18	2.24	......	......	2.5	2.55	......	......	3.51	3.75

NOTE.— Relation of gage height to discharge affected by ice January 4th to March 16th. For the purpose of comparison, gage heights for both the chain and automatic gages are published. Since the mouth of the intake pipe to the automatic gage is located a few feet downstream from the chain gage, the gage readings do not agree exactly, owing to the slope and that the slope varies with the stage. The gage heights given for the automatic gage are the means of hourly readings for 24-hour periods; those for the chain gage are the means of two readings, which are usually taken at 8 a. m. and 5 p. m.

Daily discharge, in second-feet, from automatic and chain gages, of Genesee River at St. Helena, N. Y., for 1912.

DAY.	January.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1	1,070	......	......	......	17,100	15,900	3,240	3,600	432	424	116	84	101	93	265	241	1,100	530	374	377	416	424
2	881	......	......	......	14,900	15,900	2,150	2,100	379	377	129	118	146	142	1,130	1,480	1,940	1,780	410	400	562	502
3	780	......	......	......	8,160	7,120	1,680	1,620	416	400	137	103	151	134	1 190	1,110	980	920	458	474	4,780	4,940
4	......	......	......	......	4,680	4,470	1,360	1,340	522	530	64	20	154	123	775	710	681	660	416	400	2,250	2,270
5	......	......	......	......	7,360	7,720	1,110	1,060	390	400	129	134	199	216	492	502	562	530	374	373	1,520	1,620
6	......	......	......	......	12,400	10,400	1,060	1,010	341	368	124	114	175	212	400	377	464	449	345	359	3,420	4,940
7	......	......	......	......	11,300	10,400	1,130	1,160	319	351	66	56	148	153	421	424	410	400	400	359	2,620	2,620
8	......	......	......	......	9,040	8,660	980	1,010	298	329	146	128	127	125	327	342	360	350	2,870	3,400	1,500	1,480
9	......	......	......	......	4,630	4,470	840	785	269	270	121	126	121	145	285	259	341	350	1,980	2,440	890	830
10	......	......	......	......	4,430	4,470	830	830	265	255	82	78	119	109	249	270	355	377	2,230	2,440	775	740
11	......	......	......	......	3,080	3,000	748	740	238	219	196	142	66	66	216	219	598	530	1,520	1,620	820	875
12	......	......	......	......	3,030	3,000	620	625	234	212	257	259	106	116	192	199	681	660	1,120	1,060	605	590
13	......	......	......	......	5,100	4,940	766	740	189	199	249	263	140	145	216	226	486	474	900	920	426	449
14	......	......	......	......	3,280	3,200	880	875	227	241	213	216	189	216	151	142	432	424	840	920	469	449
15	......	......	......	......	3,680	5,190	793	740	213	233	210	212	151	139	137	233	355	377	802	875	510	474
16	......	......	......	......	3,660	3,600	1,640	1,340	206	241	193	193	129	106	355	259	310	313	697	700	555	502
17	......	......	7,430	7,420	2,530	2,440	5,650	5,720	224	223	139	139	111	93	734	740	289	289	620	590	529	502
18	......	......	10,400	10,000	2,080	2,100	2,870	3,000	213	212	163	150	74	70	498	502	269	289	598	590	548	530
19	......	......	10,200	8,980	1,920	1,940	1,860	1,780	206	216	148	134	163	174	442	429	265	297	502	590	681	700
20	......	......	10,800	10,000	1,620	1,550	1,440	875	192	193	119	123	140	134	432	424	249	263	548	590	748	830
21	......	......	4,680	4,470	1,360	1,280	1,150	1,110	210	199	76	70	143	142	369	368	270	270	535	530	598	590
22	......	......	2,560	2,440	1,230	1,160	1,110	1,160	192	199	196	216	140	162	302	309	241	241	481	474	510	474
23	......	......	2,060	1,940	1,750	1,620	1,030	1,060	119	163	137	134	143	142	289	301	700	700	437	424	469	474
24	......	......	1,840	2,100	1,790	1,780	784	830	189	193	137	142	140	139	306	317	1,480	1,480	410	424	469	449
25	......	......	1,380	1,160	1,550	1,480	635	660	182	189	114	100	119	123	757	785	1,110	1,010	448	474	453	424
26	......	......	1,110	1,010	1,180	1,160	548	530	179	186	146	131	199	186	930	965	1,370	1,280	475	474	426	449
27	......	......	1,140	1,160	980	1,010	492	474	119	95	202	216	390	625	722	625	940	920	486	530	421	400
28	......	......	2,250	3,000	860	830	437	449	119	114	151	128	612	590	766	785	658	660	481	474	350	355
29	......	......	14,000	7,500	2,760	2,810	121	424	140	106	202	199	374	373	512	530	535	560	453	471	281	248
30	......	......	16,000	13,900	8,020	7,420	437	424	106	106	163	159	302	313	620	660	453	530	442	474	481	474
31	......	......	10,700	8,660	......	......	529	530	......	......	127	131	257	270	......	......	400	400	......	......	1,260	1,410

NOTE.— Daily discharge January 1st to 3d and March 17th to December 31st, determined from a well-defined rating curve. The same rating curve was used for both sets of gage heights by applying a well-defined table of relation. (See First Annual Report, Conservation Commission.)

Discharge January 4th to March 16th determined by means of a rating curve based on measurements made under ice conditions, assuming a gradual change from open water to complete ice cover on February 10th.

Daily estimates not published for period of ice conditions because lower accuracy due to those conditions would prevent intelligent comparison.

Monthly discharge of Genesee River at St. Helena, N. Y., for 1912.
[Drainage area, 1,030 square miles.]

MONTH.	Discharge in second-feet.										Run-off depth in inches on drainage area.	Accuracy.
	Maximum.						Minimum.	Mean.		Per square mile.		
	Automatic Gage.				Chain Gage.			Automatic gage.	Chain gage.			
	Day.	Hour.	Crest gage height.	Crest discharge.	Date.	24-hr. discharge.						
January	20	12:45 P.M.	4.76	3,260	....	....	360	669	......	.650	.75	B
February	23	9:45 P.M.	5.03	3,840	....	....	230	409	......	.397	.43	B
March	30	1:00 A.M.	9.51	22,700	Mar. 29	17,500	456	3,500	......	3.40	3.92	B
April	1	4:00 A.M.	9.26	21,200	Apr. 1-2	15,900	860	4,850	4,700	4.71	5.26	A
May	17	3:00 A.M.	6.25	7,200	May 17	5,720	421	1,270	1,250	1.23	1.42	A
June	4	5:30 A.M.	2.83	598	June 4	530	106	244	248	.237	.26	A
July	12	3:30 A.M.	2.18	257	July 13	263	64	150	143	.146	.17	B
August	27	5:30 P.M.	3.61	1,390	Aug. 27	625	66	178	186	.173	.20	B
September	2	4:30 P.M.	3.94	1,850	Sept. 2	1,480	137	485	492	.471	.53	A
October	2	12:30 A.M.	4.53	2,820	Oct. 2	1,780	241	622	593	.604	.70	A
November	8	8:30 A.M.	4.78	3,300	Nov. 8	3,400	345	757	808	.735	.82	A
December	3	5:45 A.M.	5.95	6,260	Dec. 3	4,940	281	979	1,030	.950	1.10	A
The year	Mar. 30	1:00 A.M.	9.51	22,700	Mar. 29	17,500	64	1,180	......	1.15	15.56	

Genesee River at Jones' Bridge near Mt. Morris, N. Y.

Location.— At the highway bridge known as Jones' Bridge about 5 miles below the village of Mt. Morris, 6 miles by river above the village of Geneseo, 1¾ miles below the inflow of Canaseraga creek (coming in from the right) and about 1¾ miles above the mouth of Beads creek (coming in from the left).

Records available.— May 22, 1903, to Apirl 30, 1906; August 12, 1908, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 1,410 square miles. (From U. S. G. S. Water Supply papers.)

Gage.— Chain, fastened to upstream side of highway bridge; read twice daily; datum unchanged.

Channel.— Sandy clay; liable to shift, but measurements have shown it to be fairly permanent in recent years

Discharge measurements.— Made at all stages from foot bridge erected on the outriggers of the bridge.

Winter flow.— Relation between gage height and discharge for the winter months considerably affected by ice. Volume of flow during the winter months determined chiefly by comparison with the flow of the Genesee at Rochester and at St. Helena.

Accuracy.— Discharge curve well developed and data as published for open water periods believed to be very good.

Co-operation.— Established by United States Geological Survey in 1903 in co-operation with the State Engineer and Surveyor of New York; re-established in 1908 in co-operation with the State New York Water Supply Commission.

Discharge measurements of Genesee River at Jones' Bridge, near Mt. Morris, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 13 *a*......	G. H. Canfield....................................	7.34	857
July 18 *b*......	Frank Weber....................................	3.90	257

a Partly open at bridge. Control frozen.
b Wading under bridge.

Daily gage height, in feet, of Genesee River at Jones' Bridge, near Mt. Morris, N. Y., for 1912.
[J. W. Trewer, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	6.4	......	8.8	26.2	11.6	4.95	3.61	3.61	4.3	5.4	4.75	4.9
2......	6.3	......	8.6	26.1	8.9	4.75	3.56	3.66	5.8	8.0	4.7	5.1
3......	5.9	......	7.3	23.9	7.8	4.85	3.57	3.78	6.7	6.1	4.8	12.2
4......	5.8	......	7.0	17.8	7.0	5.0	3.47	3.92	6.2	5.5	4.8	8.6
5......	8.1	......	6.8	16.2	6.5	4.75	3.61	3.9	5.4	5.2	4.75	7.1
6......	......	......	6.6	22.5	6.3	4.6	4.05	4.05	5.1	5.0	4.6	9.2
7......	......	......	6.6	21.8	6.4	4.45	3.61	4.05	4.9	4.9	4.6	9.8
8......	......	......	6.7	21.8	6.2	4.4	3.61	3.82	4.9	4.7	8.4	7.3
9......	......	......	7.0	16.0	6.0	4.35	3.48	3.69	4.5	4.65	8.1	6.1
10......	......	......	7.6	13.3	5.7	4.2	4.55	3.68	4.25	4.55	8.2	5.6
11......	......	......	7.8	10.9	5.6	4.2	4.1	3.54	4.2	5.0	7.0	5.8
12......	......	......	7.5	9.9	5.5	4.25	4.4	3.55	4.2	5.5	6.2	5.6
13......	......	......	7.4	13.2	5.6	4.15	4.35	3.66	4.25	5.0	5.9	6.4
14......	......	......	7.4	10.7	5.9	4.05	4.25	3.49	4.15	4.9	5.7	6.3
15......	......	......	8.2	10.5	5.7	4.1	4.1	3.82	3.82	4.7	5.7	6.2
16......	......	......	13.8	11.3	6.3	3.95	4.2	3.78	4.15	4.5	5.6	5.5
17......	......	......	22.6	10.0	13.4	4.05	4.05	3.69	5.7	4.45	5.4	5.5
18......	......	......	24.7	8.6	10.4	4.15	3.88	3.56	5.1	4.4	5.3	5.2
19......	......	......	25.0	8.3	8.3	4.05	3.89	3.75	4.95	4.35	5.2	5.4
20......	......	......	24.7	7.6	7.3	3.99	3.71	3.79	4.85	4.35	5.1	5.5
21......	......	......	18.2	7.0	6.6	3.98	3.6	3.91	4.7	4.3	5.1	5.2
22......	......	......	11.0	6.8	6.2	4.0	3.81	4.15	4.4	4.2	5.1	5.2
23......	......	......	9.8	6.5	6.4	3.82	3.85	4.0	4.35	4.35	4.9	5.1
24......	......	......	8.8	7.8	5.8	3.87	3.88	4.1	4.5	7.1	4.8	5.2
25......	......	......	7.6	7.4	5.4	4.1	3.91	3.82	5.2	6.0	4.85	5.0
26......	......	......	6.9	6.7	5.2	4.05	3.64	3.95	6.1	6.7	5.0	5.0
27......	......	......	7.3	6.3	5.0	3.92	3.71	4.2	5.4	6.0	5.0	5.0
28......	......	10.2	8.4	6.0	4.85	3.77	3.81	5.7	5.7	5.5	5.1	4.6
29......	......	9.9	20.7	7.1	4.8	3.75	3.82	5.4	5.2	5.2	5.0	4.5
30......	......	......	25.8	17.4	4.9	3.71	4.0	4.45	5.0	5.0	4.95	5.0
31......	......	......	24.2	......	5.2	......	3.71	4.2	......	4.85	......	6.2

NOTE.— Relation of gage height to discharge affected by ice January 5th to March 16th.

Daily discharge, in second-feet, of Genesee River at Jones Bridge, near Mt. Morris, N. Y., for 1912

DAY.	Jan.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,450	......	16,500	4,870	687	175	175	402	910	595	664
2	1,400	......	16,400	2,980	595	162	188	1,120	2,400	572	760
3	1,180	......	14,700	2,270	641	185	222	1,620	1,280	618	5,220
4	1,120	......	9,800	1,790	710	141	267	1,340	960	618	2,790
5	......	......	8,520	1,500	595	175	260	910	810	595	1,850
6	......	......	13,600	1,400	528	311	311	760	710	528	3,190
7	......	......	13,000	1,450	463	175	311	664	664	528	3,610
8	......	......	13,000	1,340	442	175	234	664	572	2,660	1,970
9	......	......	8,360	1,230	422	143	195	484	550	2,460	1,280
10	......	......	6,200	1,060	364	506	193	383	506	2,530	1,010
11	......	......	4,380	1,010	364	328	158	364	710	1,790	1,120
12	......	......	3,680	960	383	442	160	364	960	1,340	1,010
13	......	......	6,120	1,010	346	422	188	383	710	1,180	1,450
14	......	......	4,240	1,175	311	383	146	346	664	1,060	1,400
15	......	......	4,100	1,060	328	328	234	234	572	1,060	1,340
16	......	......	4,660	1,400	277	364	222	346	481	1,010	960
17	......	13,600	3,750	6,280	311	311	195	1,060	463	910	960
18	......	15,300	2,790	4,030	346	254	162	760	442	860	810
19	......	15,600	2,600	2,600	311	257	213	687	422	810	910
20	......	15,300	2,150	1,970	291	201	225	641	422	760	960
21	......	10,100	1,790	1,550	287	172	263	572	402	760	810
22	......	4,450	1,670	1,340	294	231	346	442	364	760	810
23	......	3,610	1,500	1,450	234	244	294	422	422	664	760
24	......	2,920	2,270	1,120	250	254	328	484	1,850	618	810
25	......	2,150	2,030	910	328	263	234	810	1,230	641	710
26	......	1,730	1,620	810	311	182	277	1,280	1,620	710	710
27	......	1,970	1,400	710	267	201	364	910	1,230	710	710
28	......	2,660	1,230	641	219	231	1,060	1,060	960	760	528
29	......	12,100	1,850	618	213	234	910	810	810	710	484
30	......	16,200	9,480	661	201	294	463	710	710	687	710
31	......	14,900	......	810	......	201	364	......	641	......	1,340

NOTE.— Daily discharge determined from a well defined rating curve.

Monthly discharge of Genesee River at Jones Bridge, near Mt. Morris, N. Y., for 1912.

[Drainage area, 1,410 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	780	.553	.64	C
February	....	....	580	.411	.44	C
March	16,200	....	4,500	3.19	3.68	B
April	16,500	1,230	6,110	4.33	4.83	A
May	6,280	618	1,680	1.19	1.37	A
June	710	201	377	.267	.30	A
July	506	141	256	.182	.21	A
August	1,060	146	296	.210	.24	A
September	1,620	234	701	.497	.55	A
October	2,400	364	821	.582	.67	A
November	2,660	528	983	.697	.78	A
December	5,220	484	1,340	.950	1.10	A
The year	16,500	141	1,540	1.09	14.81	

NOTE.— Discharge January 5 to March 16 estimated by means of comparison with the discharge at Rochester.
Mean discharge January 5–31 estimated 705 second-feet.
Mean discharge March 1–16 estimated 430 second-feet.

Genesee River at Rochester, N. Y.

Location.— At the highway bridge known locally as Elmwood Avenue Bridge, at the north end of South Park, 3½ miles above the center of the city of Rochester, 3¼ miles below the mouth of Black creek (coming in from the left) and 7½ miles above the mouth of the river.

Records available.— February 9, 1904, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York. Elevation of water surface, measurements, and records of flow of Genesee river at Rochester during flood stages and low water previous to 1904, published in annual reports of the State Engineer and Surveyor, 1902–1903–1904 and in Water Supply Papers 24, 65 and 97.

Drainage area.— 2,360 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Prior to 1910, a staff gage bolted to the downstream end of the first pier from the right hand abutment was read once daily. From Deecmber, 1910, to December, 1912, gage heights recorded by a Gurley automatic water stage register in the pump house immediately below the bridge on the right hand bank. Elevation of zero of gage, 506.848 Barge Canal datum and 245.591 Rochester City datum. Gage datum unchanged since installation of the station.

Channel.— Gravel, smooth; considered permanent.

Discharge measurements.— Made from bridge at which the staff gage is located. Prior to 1904, measurements and elevations of water surface taken in conjunction with the water flowing over and around Johnson-Seymour dam in the city of Rochester.

Winter flow.— Affected by ice for short periods although as a rule the channel is open.

Accuracy.— Discharge rating curve well developed for all stages; published data considered good for periods of open water.

Co-operation.— Maintained by the United States Geological Survey in co-operation with the New York State Barge Canal and the engineer department of the city of Rochester from 1904 to 1909; from December, 1909, maintained in co-operation with the State of New York Conservation Commission and the engineer department, city of Rochester.

Discharge measurements of Genesee River at Rochester, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 13 *a*	C. S. De Golyer	1.76	342
Mar. 15 *b*	G. H. Canfield	3.10	1,830

a Measurement made under complete ice cover, about 1,500 feet above bridge.
b Measurement made under complete ice cover, about 1,000 feet below gage.

Daily gage height, in feet, of Genesee River at Rochester, N. Y., for 1912.
[Gurley automatic gage.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.14	2.04	3.85	9.4	5.5	1.76	1.04	1.04	1.09	1.44	.58	1.41
2	2.09	1.99	3.37	9.9	4.0	1.78	1.07	1.03	1.0	2.02	1.11	1.41
3	2.03	1.93	2.95	10.1	3.2	1.54	1.05	1.02	1.63	2.15	1.0	1.74
4	2.06	1.89	2.65	9.7	2.8	1.28	1.05	1.03	2.09	1.74	1.0	3.72
5	1.94	1.88	2.45	8.4	2.49	1.52	1.07	1.01	1.86	1.53	.77	2.99
6	......	1.85	2.32	7.6	2.32	1.85	1.07	1.05	1.57	1.41	.62	2.46
7	......	1.8	2.24	8.0	2.28	1.75	1.06	1.02	1.4	1.33	1.03	3.44
8	......	1.77	2.24	8.2	2.3	1.68	1.04	1.02	1.32	1.3	1.56	3.2
9	2.14	1.78	2.34	8.1	2.21	1.65	.98	1.0	1.25	1.24	2.76	2.45
10	2.29	1.8	2.43	6.8	2.09	1.58	.98	.99	1.19	1.19	2.56	1.92
11	2.25	1.8	2.57	5.5	2.0	1.56	1.16	.99	1.13	1.19	2.51	1.84
12	2.04	1.76	2.76	4.6	1.92	1.54	1.24	......	1.08	1.26	2.17	2.05
13	1.91	1.77	2.74	4.5	1.88	1.52	1.22	......	1.03	1.48	1.95	2.56
14	1.9	1.74	2.69	4.8	1.9	1.48	1.18	.92	1.02	1.37	1.81	2.33
15	1.79	1.74	3.32	4.3	1.96	1.41	1.2	.91	1.02	1.3	1.75	1.96
16	1.76	1.76	5.4	4.45	1.99	1.4	1.44	.9	1.0	1.23	1.71	1.7
17	1.75	1.76	7.5	4.3	3.5	1.34	1.26	.91	.96	1.15	1.6	1.64
18	1.73	1.75	6.6	3.7	4.8	1.34	1.12	.96	.95	1.1	1.54	1.59
19	1.72	1.74	7.1	3.4	3.85	1.36	1.04	.92	1.17	1.05	1.51	1.59
20	1.86	2.23	8.6	3.2	3.1	1.34	1.01	.93	1.54	.98	1.46	1.64
21	2.13	3.44	9.0	2.95	2.85	1.26	1.03	.98	1.44	.89	1.44	1.7
22	2.72	3.18	7.7	2.75	2.85	1.23	1.02	.97	1.34	.92	1.44	1.61
23	2.84	2.7	5.2	2.9	2.8	1.25	1.01	1.02	1.3	.95	1.38	1.69
24	2.72	2.81	4.05	3.2	2.7	1.19	1.03	1.02	1.21	.95	1.38	1.45
25	2.6	2.85	3.5	3.15	2.33	1.19	1.03	1.0	1.2	1.8	1.37	1.48
26	2.45	3.07	3.05	2.9	2.07	1.18	1.0	.94	1.19	1.85	1.36	1.43
27	2.29	3.39	2.9	2.6	1.93	1.18	.97	.96	1.21	1.89	1.36	1.41
28	2.17	3.85	3.8	2.37	1.78	1.16	.98	1.02	1.67	1.89	1.42	1.42
29	2.14	4.05	5.9	2.24	1.73	1.09	1.03	1.44	1.69	1.56	1.4	1.45
30	2.1	......	7.8	3.85	1.66	1.04	1.08	1.34	1.47	1.34	1.38	1.32
31	2.07	......	8.9	......	1.67	......	1.05	1.19	......	1.14	......	1.41

NOTE.— Relation of gage height to discharge affected by ice, January 4 to March 17.
Mean daily gage height obtained by averaging hourly readings for each 24 hour period.

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1,850	740	3,110	22,800	9,900	1,240	354	354	396	782	102	743
2.....	1,760	640	2,250	24,700	5,800	1,270	380	346	320	1,640	414	743
3.....	1,650	580	1,610	25,400	3,940	916	362	337	1,040	1,870	320	1,210
4.....	1,660	520	1,200	24,000	3,100	588	362	346	1,760	1,210	320	5,130
5.....	1,440	500	958	19,200	2,480	888	380	328	1,390	902	178	3,480
6.....	1,400	460	812	16,400	2,180	1,380	380	362	958	743	118	2,430
7.....	1,400	420	730	17,800	2,100	1,220	371	337	730	646	345	4,470
8.....	1,500	360	730	18,500	2,140	1,120	354	337	634	610	944	3,940
9.....	1,600	360	834	18,200	1,980	1,080	306	320	555	544	3,020	2,410
10.....	1,840	360	934	13,900	1,760	972	306	313	490	490	2,620	1,480
11.....	1,660	360	1,100	9,900	1,600	944	462	313	433	490	2,520	1,360
12.....	1,340	834	1,340	7,380	1,480	916	544	297	388	566	1,910	1,690
13.....	1,100	340	1,310	7,100	1,420	888	522	281	345	834	1,520	2,620
14.....	1,080	321	1,250	7,940	1,450	834	481	264	337	694	1,320	2,190
15.....	880	321	2,170	6,580	1,540	743	500	257	337	610	1,220	1,540
16.....	840	334	6,700	6,970	1,580	730	782	250	320	533	1,160	1,150
17.....	780	334	16,100	6,580	4,600	658	566	257	292	452	1,000	1,060
18.....	760	328	13,200	5,080	7,940	658	424	292	285	405	916	986
19.....	700	321	14,800	4,380	5,440	682	354	264	471	362	874	986
20.....	880	720	20,000	3,940	3,720	658	328	271	916	306	808	1,060
21.....	1,170	2,370	21,400	3,400	3,200	566	346	306	782	244	782	1,150
22.....	2,000	1,950	16,800	3,000	3,200	533	337	299	658	264	782	1,020
23.....	2,140	1,260	9.060	3.300	3.100	555	328	337	610	285	706	1,140
24.....	1,960	1,410	5,930	3,940	2,900	490	346	337	511	285	706	795
25.....	1,700	1,460	4,600	3,830	2,190	490	346	320	500	1,300	694	834
26.....	1,500	1,780	3,610	3,300	1,730	481	320	278	490	1,380	682	769
27.....	1,200	2,280	3,300	2,700	1,500	481	299	292	511	1,440	682	743
28.....	1,000	3,110	5,320	2,270	1,270	462	306	337	1,100	1,440	756	756
29.....	920	3,510	11,100	2,030	1,200	396	346	782	1,140	944	730	795
30.....	860	......	17,100	5,440	1,090	354	388	658	821	658	706	634
31.....	780	......	21,000	......	1,100	......	362	490	......	443	......	743

NOTE.— Daily discharge January 1-3 and March 17 to December 31, determined from a fairly well defined rating curve.

Daily discharge, February 10 to March 15, determined from a rating curve based on measurements made under ice conditions.

Daily discharge January 4 to February 9, estimated, assuming that the conditions of flow were changing gradually from open water to complete ice cover.

March 16, estimated.

Monthly discharge of Genesee River at Rochester, N. Y., for 1912.

[Drainage area, 2,360 square miles.]

MONTH.	Maximum.				Minimum.	Mean.	Per square mile.	Run-off depth in inches.	Accuracy.
	Day.	Hour.	Gage height.	Discharge.					
			Feet.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*		
January..........	23	9 P.M.	2.93	*a* 2,300	*a* 700	1,330	.564	.65	B
February..........	29	11:45 A.M.	4.09	*a* 3,550	*a* 320	958	.406	.44	B
March..........	20	10:45 P.M.	9.26	22,300	*a* 730	6,790	2.88	3.32	B
April..........	3	12:45 P.M.	10.10	25,500	2,000	10,000	4.24	4.73	A
May..........	1	5 A.M.	5.87	11,000	1,060	2,860	1.21	1.40	A
June..........	2	6 A.M.	1.92	1,480	320	773	.328	.37	A
July..........	16	3:15 A.M.	1.53	902	271	395	.167	.19	B
August..........	29	1:30 P.M.	1.50	860	238	341	.144	.17	B
September..........	3	11:30 P.M.	2.16	1,890	257	651	.276	.31	A
October..........	2	9:45 P.M.	2.43	2,370	232	754	.319	.37	A
November..........	9	8:30 P.M.	2.88	3,260	......	962	.408	.46	A
December..........	4	10:30 A.M.	3.91	5,580	610	1,610	.682	.79	A
The year..........	Apr. 3	12:45 P.M.	10.10	25,500	......	2,280	.966	13.20	

a Discharge from ice rating.

CANASERAGA CREEK DRAINAGE BASIN.

Description.

Canaseraga creek, one of the most important tributaries to the Genesee river from the east, rises in the extreme northwestern corner of Steuben county and flows in a northwestern direction to its junction with the Genesee river, a short distance below the village of Mt. Morris.

Through its entire course the creek flows through a flat, fertile valley, devoted almost entirely to the pursuit of agriculture. From the village of Dansville to Mt. Morris, a distance of 22½ miles, the river winds back and forth across the valley. The velocity is so slow that the large amount of silt which is brought down from the foot hills by the smaller streams is deposited in the creek bed, raising it to an elevation higher, in many cases, than the surrounding country. The deposit of silt coupled with the extreme deviation of the creek from a straight line, causes the 11,000 acres, which border on the stream, below Dansville to become annually inundated by the flood waters. The State Water Supply Commission, acting upon the petition of the people residing in the vicinity, and under the authority acquired in 1906 when the duties of the River Improvement Commission were transferred to them, have sold bonds to the extent of $200,000 and work is now being started which is expected to alleviate much of the damage caused by flooding.

Keshequa creek, the principal tributary to Canaseraga creek, has its source among the hills of northern Allegany county and flows north and northeast through Nunda and Tuscarora joining Canaseraga creek near Sonyea, the home of the Craig Colony for epileptics. Throughout its length of some 20 miles it flows through a narrow valley and falls about 1,200 feet. No power is developed as the flow during the summer averages only 3 to 6 second-feet. The yearly rain fall is a little above the average for the Genesee Valley and ranges from 28 to 36 inches.

Canaseraga Creek at Dansville.

Location.—At the highway bridge, 1 mile due west from the village of Dansville, about 2,200 feet below the mouth of Mill Brook (coming in from the right), and about 22 miles above the mouth of the creek.

Records Available.— July 21, 1910, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 167 square miles. (From U. S. G. S. topographic sheets and Bien's Atlas.)

Gage.— Staff, bolted to the downstream side of the left-hand abutment; read twice daily; datum unchanged.

Channel.— Sand and gravel, shifting during high water.

Discharge measurements.—At high stages made from bridge. Low water measurements made by wading below the bridge.

Winter flow.— The relation of gage height to discharge is affected by ice.

Accuracy.— Discharge rating curves somewhat uncertain because of shift in channel. Estimates as published only fair.

Discharge measurements of Canaseraga Creek at Dansville, N. Y., in 1912.

DATE.		Hydrographer.	Gage height.	Discharge.
			Feet.	*Sec.-ft.*
Mar.	12	G. H. Canfield *a*	2.61	97.3
	17	do	4.21	1,500
	18	do	3.58	984
	23	do	2.67	263
	24	do	2.53	200
April	4	G. K. Larrison	3.05	409
	6	do	3.82	1,110
July	19 *b*	Frank Weber	2.13	33.4
Sept.	23 *c*	J. G. Mathers	2.09	29.2
	23 *c*	do	2.10	31.0
Oct.	26 *c*	C. S. De Golyer	2.37	75.3
	26 *c*	do	2.37	73.5
	28 *c*	do	2.27	50.9

a Made ½ mile below station. Ice at control.
b Made by wading above bridge.
c Made by wading below gage.

Daily gage height, in feet, of Canaseraga Creek at Dansville, N. Y., for 1910.
[Floyd Harter, observer.]

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.75	1.82	1.75	1.78	1.92	17	.....	1.75	1.75	1.72	1.82	.....
2	.....	1.75	1.75	1.7	1.8	1.98	18	.....	1.78	1.75	1.72	1.82	.....
3	.....	1.78	1.88	1.7	1.75	2.08	19	.....	1.85	1.78	1.68	1.92	.....
4	.....	1.78	1.8	1.68	1.8	2.02	20	.....	1.78	1.75	1.68	1.88	.....
5	.....	1.75	1.75	1.68	1.8	2.0	21	1.75	1.75	1.72	1.72	1.82	.....
6	.....	1.75	1.85	1.75	1.8	1.92	22	1.72	1.75	1.72	1.75	1.8	.....
7	.....	1.78	1.78	1.95	1.78	1.9	23	1.75	1.72	1.72	1.72	1.85	.....
8	.....	1.75	1.75	1.78	1.78	1.82	24	1.78	1.7	1.85	1.75	1.8	.....
9	.....	1.75	1.78	1.75	1.9	1.88	25	1.75	1.72	1.78	1.88	2.08	.....
10	.....	1.92	1.75	1.75	2.02	1.85	26	1.75	1.82	1.75	1.82	2.02	.....
11	.....	1.82	1.72	1.72	2.15	.....	27	1.75	1.75	1.75	1.82	1.95	.....
12	.....	1.75	1.72	1.75	1.92	.....	28	1.8	1.75	1.72	1.8	2.05	.....
13	.....	1.75	1.72	1.72	1.8	.....	29	1.75	1.72	1.72	1.82	2.0	.....
14	.....	1.75	1.75	1.7	1.82	.....	30	1.85	1.72	1.75	1.8	1.92	.....
15	.....	1.72	1.72	1.72	1.8	.....	31	1.75	1.72	.....	1.82	.....	.....
16	.....	1.72	1.72	1.7	1.85	.....							

Daily gage height, in feet, of Canaseraga Creek at Dansville, N. Y., for 1911
[Floyd Harter, observer.]

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	3.2	2.18	2.32	2.18	1.8	1.6	2.22	2.06	2.09	2.24
2	......	3.2	2.05	2.55	2.18	1.78	1.6	1.95	2.2	2.06	2.19
3	......	2.95	2.1	2.42	2.05	1.75	1.62	1.94	1.99	2.03	2.22
4	......	2.78	2.12	2.32	1.98	1.7	1.82	1.81	2.06	1.92	2.24
5	......	2.88	3.08	2.28	2.1	1.62	1.78	1.98	2.03	1.99	2.12
6	......	2.8	3.05	2.2	2.08	1.68	1.7	1.98	1.92	2.01	2.16
7	......	2.55	3.85	2.12	1.98	1.7	1.68	1.84	2.89	2.18	2.19
8	......	2.58	3.4	2.15	2.02	1.68	1.72	2.24	2.74	2.02	2.24
9	......	2.78	2.92	2.12	1.92	1.72	1.68	2.06	2.74	2.29	2.18
10	......	3.15	2.82	2.02	1.9	1.7	1.6	1.89	2.51	2.16	2.32
11	......	3.4	2.72	2.02	2.05	1.72	1.68	1.81	2.24	2.08	2.24
12	......	3.65	2.52	1.98	2.2	1.7	1.6	1.88	2.26	2.19	2.36
13	......	3.9	2.45	1.92	2.28	1.72	1.62	1.94	2.12	2.2	3.2
14	......	4.2	2.6	1.92	2.18	1.7	1.6	1.84	2.04	2.18	2.95
15	......	4.2	2.48	1.9	2.05	1.65	1.8	1.81	2.04	2.26	2.69
16	......	3.45	2.32	1.82	1.95	1.7	2.1	1.82	1.96	2.18	2.95
17	2.33	3.15	2.45	2.02	1.88	2.05	1.88	1.82	1.92	2.29	2.91
18	3.4	3.3	2.4	2.05	......	1.95	1.98	1.8	2.04	2.91	2.69
19	3.6	3.3	2.3	1.92	1.82	1.82	1.88	1.88	1.94	2.59	2.64
20	3.4	3.05	2.48	1.92	1.8	1.98	1.72	1.86	1.88	2.5	2.29
21	3.05	2.78	2.4	1.95	1.82	1.8	1.7	1.79	1.89	2.31	2.11
22	2.82	2.78	2.45	1.92	1.88	1.78	1.72	1.78	1.96	2.24	2.2
23	2.35	2.75	2.62	1.95	1.82	1.75	1.72	1.81	2.01	2.18	2.59
24	2.08	2.48	2.48	2.05	1.8	1.72	1.8	1.85	1.92	2.25	2.62
25	2.45	2.88	2.32	2.18	1.82	1.7	2.02	1.84	1.94	2.21	2.49
26	2.94	2.95	2.22	2.08	1.8	1.68	1.88	1.91	1.88	2.19	2.39
27	3.4	4.15	2.12	1.98	1.88	1.65	1.72	1.82	1.99	2.18	2.81
28	3.35	3.8	2.02	1.95	2.02	1.62	2.45	1.84	1.96	2.14	2.58
29	......	2.82	1.9	1.82	1.92	1.62	2.5	1.92	1.92	2.39	2.41
30	......	2.58	1.88	1.8	1.8	1.62	2.22	1.96	1.95	2.26	2.44
31	......	2.35	......	1.95	......	1.6	2.2	......	2.14	......	2.75

Daily gage height, in feet, of Canaseraga Creek at Dansville, N. Y., for 1912
[Floyd Harter, observer.]

DAY.	Jan.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.69	......	4.2	3.2	2.72	2.22	2.12	2.38	2.4	2.22	2.32
2	2.54	......	4.5	3.05	2.72	2.22	2.18	3.18	2.22	2.18	2.3
3	2.34	......	3.3	2.98	2.82	2.25	2.28	2.92	2.2	2.22	2.4
4	......	......	3.1	2.88	2.72	2.2	2.32	2.48	2.15	2.18	2.7
5	......	......	4.0	2.72	2.72	2.22	2.22	2.22	2.18	2.2	2.62
6	......	......	4.15	2.62	2.75	2.32	2.32	2.16	2.15	2.18	2.72
7	......	......	4.1	2.72	2.6	2.3	2.22	2.12	2.18	2.62	2.55
8	......	......	3.3	2.78	2.48	2.22	2.13	2.1	2.18	2.82	2.32
9	......	......	3.2	2.55	2.42	4.2	2.12	2.13	2.18	2.62	2.28
10	......	......	3.05	2.45	2.35	3.55	2.12	2.12	2.22	2.48	2.3
11	......	......	2.98	2.5	2.32	3.2	2.1	2.12	2.15	2.32	2.32
12	......	......	2.98	2.58	2.32	3.2	2.14	2.15	2.18	2.32	2.32
13	......	2.15	2.88	2.7	2.32	2.9	2.08	2.12	2.15	2.28	2.3
14	......	1.92	3.0	2.52	2.28	3.3	2.02	2.18	2.12	2.32	2.38
15	......	3.65	3.3	2.48	2.22	2.72	2.02	2.22	2.08	2.28	2.35
16	......	3.8	3.1	3.4	2.28	2.52	2.0	2.3	2.05	2.25	2.42
17	......	3.9	2.92	3.35	2.28	2.38	2.08	2.18	2.1	2.32	2.42
18	......	4.1	3.1	3.3	2.22	2.32	2.28	2.4	2.08	2.3	2.55
19	......	3.85	2.82	3.2	2.2	2.2	2.22	2.22	2.08	2.25	2.5
20	......	3.7	2.2	3.1	2.22	2.2	2.3	2.22	2.1	2.25	2.48
21	......	3.2	1.95	2.95	2.22	2.3	2.22	2.18	2.05	2.22	2.42
22	......	2.92	2.22	2.82	2.28	2.22	2.22	2.18	2.08	2.25	2.42
23	......	2.65	2.3	2.82	2.22	2.18	2.58	2.15	2.42	2.22	2.42
24	......	2.55	2.01	2.78	2.22	2.15	2.45	2.55	2.48	2.32	2.42
25	......	2.65	1.9	2.7	2.18	2.12	2.22	2.58	2.38	2.35	2.4
26	......	2.65	1.82	2.72	2.2	2.38	2.28	2.3	2.38	2.32	2.45
27	......	3.05	1.78	2.75	2.22	2.18	2.28	2.18	2.38	2.3	2.58
28	......	3.52	1.72	2.7	2.2	2.12	2.22	2.15	2.3	2.28	2.48
29	......	5.2	2.3	2.72	2.25	2.1	2.2	2.28	2.28	2.25	2.65
30	......	3.95	3.4	2.65	2.22	2.13	2.18	2.78	2.28	2.28	2.98
31	......	3.7	......	2.65	......	2.1	2.12	......	2.25	......	2.92

NOTE.— No information regarding ice effect. There may have been some effect during February and March, 1911, and March, 1912.

Daily discharge, in second-feet, of Canaseraga Creek at Dansville, N. Y., for 1910.

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	25	33	25	28	49	17	.....	25	25	22	33	.....
2	.....	25	25	20	30	61	18	.....	28	25	22	33	.....
3	.....	28	42	20	25	81	19	.....	38	28	18	49	.....
4	.....	28	30	18	30	69	20	.....	28	25	18	42	.....
5	.....	25	25	18	30	65	21	25	25	22	22	33	.....
6	.....	25	38	25	30	49	22	22	25	22	25	30	.....
7	.....	28	28	55	28	45	23	25	22	22	22	38	.....
8	.....	25	25	28	28	33	24	28	20	38	25	30	.....
9	.....	25	28	25	45	42	25	25	22	28	42	81	.....
10	.....	49	25	25	69	38	26	25	33	25	33	69	.....
11	.....	33	22	22	98	.....	27	25	25	25	33	55	.....
12	.....	25	22	25	49	.....	28	30	25	22	30	75	.....
13	.....	25	22	22	30	.....	29	25	22	22	33	65	.....
14	.....	25	25	20	33	.....	30	38	22	25	30	49	.....
15	.....	22	22	22	30	.....	31	25	22	.....	33	.....	.....
16	.....	22	22	20	38	.....							

Daily discharge, in second-feet, of Canaseraga Creek at Dansville, N. Y., for 1911.

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	550	105	140	105	30	10	115	77	83	120
2	......	550	75	208	105	28	10	55	110	77	108
3	......	390	85	166	75	25	12	53	63	71	115
4	......	301	90	140	61	20	33	32	77	49	120
5	......	350	468	130	85	12	28	61	71	63	90
6	......	310	450	110	81	18	20	61	49	67	100
7	......	208	1,140	90	61	20	18	36	355	105	108
8	......	218	700	98	69	18	22	120	283	69	120
9	......	301	372	90	49	22	18	77	283	132	105
10	......	515	320	69	45	20	10	44	194	100	140
11	......	700	274	69	75	22	18	32	120	81	120
12	......	930	197	61	110	20	10	42	125	108	150
13	......	1,190	175	49	130	22	12	53	90	110	550
14	......	1,520	225	49	105	20	10	36	73	105	390
15	......	1,520	184	45	75	15	30	32	73	125	261
16	......	745	140	33	55	20	85	33	57	105	390
17	142	515	175	69	42	75	42	33	49	132	366
18	700	620	160	75	38	55	61	30	73	366	261
19	880	620	135	49	33	33	42	42	53	222	241
20	700	450	184	49	30	61	22	39	42	190	132
21	450	301	160	55	33	30	20	29	44	138	88
22	320	301	175	49	42	28	22	28	57	120	110
23	148	288	233	55	33	25	22	32	67	105	222
24	81	184	184	75	30	22	30	38	49	122	233
25	175	350	140	105	33	20	69	36	53	112	187
26	384	390	115	81	30	18	42	47	42	108	158
27	700	1,460	90	61	42	15	22	33	61	105	315
28	660	1,080	69	55	69	12	175	36	57	95	218
29	......	320	45	33	49	12	190	49	49	158	163
30	......	218	42	30	30	12	115	57	55	125	172
31	......	148	......	45	......	10	110	......	93	......	288

Daily discharge, in second-feet, of Canaseraga Creek at Dansville, N. Y., for 1912.

DAY.	Jan.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	261	......	1,520	480	200	50	34	84	89	50	71
2	204	......	1,880	380	200	50	43	466	50	43	66
3	145	......	620	338	250	56	62	302	46	50	89
4	......	......	480	280	200	46	71	110	38	43	190
5	......	......	1,290	200	200	50	50	50	43	46	158
6	......	......	1,460	158	215	71	71	40	38	43	200
7	......	......	1,400	200	150	66	50	34	43	158	132
8	......	......	560	230	110	50	36	31	43	250	71
9	......	......	480	132	94	1,520	34	36	43	158	62
10	......	......	380	102	78	800	34	34	50	110	66
11	......	......	338	115	71	480	31	34	38	71	71
12	......	......	338	143	71	480	37	38	43	71	71
13	......	98	280	190	71	290	28	34	38	62	66
14	......	49	350	122	62	560	21	43	34	71	84
15	......	930	560	110	50	200	21	50	28	62	78
16	......	1,080	410	650	62	122	18	66	24	56	94
17	......	1,190	302	605	62	84	28	43	31	71	94
18	......	1,410	410	560	50	71	62	89	28	66	132
19	......	1,140	250	480	46	46	50	50	28	56	115
20	......	980	46	410	50	46	66	50	31	56	110
21	......	550	14	320	50	66	50	43	24	50	94
22	......	372	50	250	62	50	50	43	28	56	94
23	......	245	66	250	50	43	143	38	94	50	94
24	......	208	19	230	50	38	102	132	110	71	94
25	......	245	10	190	43	34	50	143	84	78	89
26	......	245	6	200	46	84	62	66	84	71	102
27	......	450	4	215	50	43	62	43	84	66	143
28	......	808	3	190	46	34	50	38	66	62	110
29	......	2,820	66	200	56	31	46	62	62	56	170
30	......	1,240	650	170	50	36	43	230	62	62	338
31	......	980	......	170	......	31	34	......	56	......	302

NOTE.— Daily discharge for 1910 and 1911 determined from a poorly-defined rating curve.
Daily discharge January 1 to 3, 1912, and March 13 to April 3, 1912, determined from a poorly-defined rating curve.
Discharge interpolated June 18, 1911.

Monthly discharge of Canaseraga Creek at Dansville, N. Y., for 1910.
[Drainage area, 167 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
July 21–31	38	22	26.6	....	....	C
August	49	20	26.4	.158	.18	C
September	42	22	26.3	.157	.18	C
October	55	18	25.7	.154	.18	C
November	98	25	43.4	.260	.29	C

Monthly discharge of Canaseraga Creek, at Dansville, N. Y., for 1911.
[Drainage area, 167 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
February 17–28	880	81	445	2.66	1.19	D
March	1,520	148	566	3.39	3.91	D
April	1,140	42	230	1.38	1.54	B
May	208	30	78.5	.470	.54	B
June	130	30	60.7	.363	.40	B
July	75	10	24.5	.147	.17	C
August	190	10	42.9	.257	.30	C
September	120	28	47	.281	.31	C
October	355	42	95	.569	.66	B
November	366	49	118	.707	.79	B
December	550	88	198	1.19	1.37	B

Monthly discharge of Canaseraga Creek, at Dansville, N. Y., for 1912.
[Drainage area, 167 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
March	2,820	49	529.0	3.17	3.66	D
April	1,880	3	475.0	2.84	3.17	B
May	650	102	267.0	1.60	1.84	B
June	250	43	93.2	.558	.62	B
July	1,520	31	182.0	1.09	1.26	B
August	143	18	49.6	.297	.34	B
September	466	31	84.1	.504	.56	B
October	110	24	50.3	.301	.35	B
November	250	43	73.8	.442	.49	B
December	338	62	118.0	.707	.82	B

NOTE.— Mean discharge March 1st to 12th estimated 110 second-feet by means of comparison with adjacent stations.

Keshequa Creek at Sonyea, N. Y.

Location.— On the second highway bridge in the village of Sonyea, 2¼ miles above its confluence with Canaseraga creek and about 4 miles downstream from Tuscarora.

Records available.— July 22, 1910, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 67 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Staff, fastened to a pile on the right bank directly back of and across from the Craig Colony power house; used for low water readings. Chain gage installed October 25, 1910, on upstream side of second bridge used since that date. Gage read twice daily. The zeros of these gages are not set at the same datum.

Channel.— Sand and gravel; shifting at high stages.

Discharge measurements.—At high stages made from either bridge; at low stages made by wading.

Winter flow.— Relation of gage height to discharge affected by ice.

Accuracy.— Discharge rating curves somewhat uncertain because of shift in channel. Estimates as published only fair.

Discharge measurements of Keshequa Creek at Sonyea, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
March 14 *a*	G. H. Canfield	5.38	81.2
16 *b*	do	5.87	630
17 *b*	do	4.99	286
19	do	4.45	255
19	do	5.06	556
23	do	3.56	50
April 5	G. K. Larrison	5.28	791
6	do	4.63	385
July 17 *c*	Frank Weber	3.17	7.3
19 *c*	do	3.03	3.7
Sept. 21 *d*	J. G. Mathers	3.11	5.82
21 *d*	do	3.10	5.53
Oct. 26 *d*	C. S. De Golyer	3.74	41.9
28 *d*	do	3.42	16.8

a Made under complete ice cover.
b Obstructed by ice.
c Made by wading below gage.
d Made by wading above gage.

Daily gage height, in feet, of Keshequa Creek at Sonyea, N. Y., for 1911.
[Elmer E. Reynolds, observer.]

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	3.7	3.72	3.58	3.18	2.95	2.9	3.05	3.15	3.2	3.4
2	......	3.6	3.65	3.68	3.2	2.9	2.88	2.98	3.45	3.18	3.42
3	......	3.6	3.75	3.68	3.2	2.95	2.92	2.95	3.2	3.15	3.32
4	......	3.6	3.7	3.58	3.12	2.98	3.12	2.98	3.18	3.15	3.25
5	......	3.6	4.7	3.48	3.1	2.88	3.0	3.0	3.15	3.15	3.2
6	......	3.5	4.4	3.4	3.1	2.92	2.95	3.25	3.15	3.2	3.35
7	......	3.45	4.3	3.48	3.1	3.0	3.0	3.12	4.18	3.42	3.35
8	......	3.5	3.98	3.45	3.1	3.02	2.98	4.55	3.5	3.5	3.45
9	......	3.65	3.95	3.4	3.05	2.98	2.95	4.5	3.42	3.52	3.52
10	......	4.55	3.92	3.35	3.05	2.92	2.92	3.9	3.3	3.45	3.55
11	......	4.85	3.85	3.35	3.05	2.95	2.95	3.38	3.4	3.35	3.55
12	......	5.1	3.7	3.35	3.1	2.95	2.92	3.45	3.42	3.35	3.88
13	......	4.65	3.62	3.28	3.32	2.92	2.88	3.38	3.4	3.38	4.75
14	......	4.5	3.6	3.25	3.2	2.85	2.88	3.2	3.32	3.35	3.95
15	......	4.2	3.58	3.25	3.15	2.9	2.92	3.2	3.2	3.35	4.1
16	......	3.95	3.55	3.25	3.1	2.88	2.95	3.05	3.2	3.4	3.95
17	5.4	3.7	3.58	3.28	3.05	3.28	2.98	3.0	3.15	3.42	4.02
18	5.35	3.65	3.6	3.25	3.05	3.2	2.95	3.0	3.2	4.15	3.75
19	4.75	3.68	3.6	3.25	3.0	2.98	2.95	3.02	3.2	4.35	3.55
20	3.9	3.7	3.6	3.2	2.98	2.95	2.92	2.98	3.2	3.5	3.35
21	3.8	3.7	3.6	3.15	3.0	2.98	2.9	2.98	3.2	3.5	3.35
22	3.8	3.98	3.6	3.12	3.0	3.0	2.9	2.98	3.25	3.5	3.38
23	3.82	3.88	3.6	3.18	3.0	3.0	2.85	3.0	3.22	3.5	4.08
24	3.78	3.82	3.58	3.5	3.0	2.98	2.8	2.98	3.2	4.5	3.58
25	3.68	3.7	3.55	3.35	2.98	2.95	3.02	2.92	3.2	4.05	3.45
26	4.25	3.72	3.55	3.3	2.92	3.0	3.08	3.0	3.18	3.5	3.45
27	4.5	4.8	3.55	3.18	2.9	3.0	3.0	3.02	3.15	3.45	3.9
28	3.85	4.18	3.5	3.1	3.05	3.0	3.35	3.05	3.15	3.52	3.6
29	......	3.82	3.4	3.02	2.95	2.88	3.25	3.08	3.15	3.7	3.45
30	......	3.85	3.35	3.0	2.95	2.85	3.3	3.2	3.15	3.45	3.45
31	......	3.75	......	3.02	......	2.88	3.08	......	3.22	......	3.45

Daily gage height, in feet, of Keshequa Creek at Sonyea, N. Y., for 1912.

[Elmer E. Reynolds, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	......	5.4	4.8	3.98	3.38	3.0	3.02	3.3	3.22	3.25	3.45
2	3.65	......	5.3	5.2	3.85	3.35	2.95	3.08	3.52	3.2	3.2	3.5
3	3.6	......	......	4.22	3.75	3.32	2.98	3.22	3.65	3.15	3.25	3.8
4	3.55	......	......	3.68	3.68	3.3	2.95	3.12	3.42	3.12	3.25	3.72
5	3.42	......	......	5.1	3.62	3.3	3.08	3.15	3.2	3.1	3.25	4.2
6	......	......	......	4.7	3.65	3.3	3.18	3.1	3.15	3.05	3.25	4.82
7	......	......	5.3	5.5	3.65	3.28	3.08	3.08	3.08	3.05	3.35	3.92
8	......	......	......	4.9	3.58	3.25	2.98	3.08	3.05	3.1	3.7	3.68
9	......	......	......	4.18	3.58	3.18	2.9	2.98	3.02	3.1	3.85	3.55
10	......	......	......	4.15	3.58	3.15	3.4	3.08	3.0	3.1	3.72	3.55
11	......	......	......	4.0	3.48	3.15	3.55	3.0	3.0	3.18	3.62	3.5
12	......	......	......	4.08	3.42	3.2	3.68	3.1	3.0	3.15	3.38	3.4
13	......	......	5.2	4.15	3.58	3.2	3.32	3.1	2.98	3.2	3.35	3.3
14	......	......	5.2	4.02	3.6	3.18	3.52	3.1	2.95	3.18	3.35	3.2
15	......	......	6.0	4.18	3.6	3.15	3.32	3.05	3.22	3.15	3.35	3.2
16	......	......	6.1	4.05	4.18	3.05	3.2	2.98	3.52	3.1	3.32	3.22
17	......	......	5.7	3.9	4.25	3.08	3.18	2.98	3.48	3.2	3.3	3.25
18	......	......	5.0	3.9	3.90	3.12	3.1	3.08	3.38	3.2	3.3	3.25
19	4.7	......	4.9	3.88	3.72	3.1	3.02	3.1	3.22	3.18	3.3	3.3
20	4.65	5.0	4.7	3.85	3.7	3.12	3.05	3.05	3.1	3.2	3.3	3.4
21	4.55	4.8	3.8	3.7	3.6	3.1	3.02	3.12	3.05	3.52	3.25	3.35
22	4.55	4.75	3.75	3.78	3.7	3.1	3.02	3.2	3.05	3.48	3.25	3.25
23	......	4.7	3.7	4.0	3.6	3.1	3.08	3.08	3.05	3.62	3.25	3.2
24	......	5.0	3.6	3.85	3.6	3.08	3.0	3.05	3.2	3.72	3.25	3.3
25	......	5.2	3.58	3.8	3.45	3.0	3.05	3.05	3.2	3.45	3.3	3.4
26	......	5.7	3.48	3.7	3.35	3.18	3.25	3.2	3.18	3.35	3.3	3.48
27	......	5.6	4.65	3.65	3.28	3.08	3.15	3.15	3.15	3.3	3.42	3.42
28	......	5.5	4.95	3.66	3.3	3.02	3.0	3.15	3.1	3.28	3.42	3.25
29	......	5.4	6.0	4.2	3.38	3.0	3.0	3.08	3.12	3.2	3.42	3.4
30	......	......	4.65	4.35	3.45	3.0	3.0	3.05	3.18	3.2	3.45	3.4
31	......	......	4.65	......	3.45	......	3.02	3.02	......	......	......	3.35

NOTE.— No information available regarding the presence of ice during 1911. The gage heights were probably affected until some time in March.

Relation of gage height to discharge affected by ice January 6 to March 17, 1912.

Daily discharge, in second-feet, of Keshequa Creek at Sonyea, N. Y., for 1911.

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	68	72	51	13	4	3	8	12	14	30
2	53	60	65	14	3	3	5	36	13	32
3	53	78	65	14	4	4	4	14	12	23
4	53	68	51	10	5	10	5	13	12	18
5	53	430	39	9	3	6	6	12	12	14
6	41	285	30	9	4	4	18	12	14	26
7	36	245	39	9	6	6	10	203	32	26
8	41	137	36	9	7	5	355	41	41	36
9	60	128	30	8	5	4	330	32	43	43
10	355	119	26	8	4	4	113	21	36	47
11	515	100	26	8	4	4	28	30	26	47
12	670	68	26	9	4	4	36	32	26	108
13	405	56	20	23	4	3	28	30	28	458
14	330	53	18	14	2	3	14	23	26	128
15	210	51	18	12	3	4	14	14	26	175
16	128	47	18	9	3	4	8	14	30	128
17	68	51	20	8	20	5	6	12	32	149
18	60	53	18	8	14	4	6	14	192	78
19	65	53	18	6	5	4	7	14	265	47
20	68	53	14	5	4	4	5	14	41	26
21	68	53	12	6	5	3	5	14	41	26
22	137	53	10	6	6	3	5	18	41	28
23	108	53	13	6	6	2	6	15	41	169
24	93	51	41	6	5	2	5	14	330	51
25	68	47	26	5	4	7	4	14	159	36
26	72	47	21	4	6	8	6	13	41	36
27	485	47	13	3	6	6	7	12	36	113
28	203	41	9	8	6	26	8	12	43	53
29	93	30	7	4	3	18	8	12	68	36
30	100	26	6	4	2	21	14	12	36	36
31	78	......	7	......	3	8	......	15	......	36

Daily discharge, in second-feet, of Keshequa Creek at Sonyea, N. Y., for 1912.

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	90	485	95	15	3	3	11	9	10	18
2	80	735	65	14	3	5	23	8	8	21
3	80	217	48	12	3	9	34	6	10	55
4	80	65	38	11	3	6	17	6	10	43
5	80	670	31	11	5	6	8	5	10	160
6	80	430	34	11	7	5	6	4	10	426
7	80	950	34	10	5	5	5	4	14	80
8	80	533	27	10	3	5	4	5	40	38
9	70	195	27	7	2	3	3	5	65	25
10	70	185	27	6	16	5	3	5	43	25
11	60	137	20	6	25	3	3	7	31	21
12	60	155	17	8	38	5	3	6	15	16
13	50	177	27	8	12	5	3	8	14	11
14	50	140	29	7	23	5	3	7	14	8
15	500	190	29	6	12	4	9	6	14	8
16	750	155	154	4	8	3	23	5	12	9
17	600	102	178	5	7	3	20	8	11	10
18	530	102	75	6	5	5	15	8	11	10
19	470	97	43	5	3	5	9	7	11	11
20	365	87	40	6	4	4	5	8	11	16
21	55	58	29	5	3	6	4	23	10	14
22	48	73	40	5	3	8	4	20	10	10
23	40	122	29	5	5	5	4	31	10	8
24	29	82	29	5	3	4	8	43	10	11
25	27	73	18	3	4	4	8	18	11	16
26	20	55	14	7	10	8	7	14	11	20
27	340	48	10	5	6	6	6	11	17	17
28	500	29	11	3	3	6	5	10	17	10
29	1,250	160	15	3	3	5	6	8	17	16
30	405	212	18	3	3	4	7	8	18	16
31	405	......	18	......	3	3	......	9	......	14

NOTE.— Daily discharge for the open water period in 1911 and 1912, except April 8 to 30, 1912 determined from two fairly well defined rating curves; one applicable, January 1 to December 31, 1911, and March 30 to April 7, 1912, and the other, January 1 to March 29 and May 1 to December 31, 1912.

Discharge April 8 to 30, 1912, obtained by the indirect method of shifting channels.

Discharge March 1 to 17, 1912, estimated by means of measurements made during the period and climatological records.

Monthly discharge of Keshegua Creek at Sonyea, N. Y., for 1911.
[Drainage area 67 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
March	670	36	156	2.33	2.69	D
April	430	26	88.5	1.32	1.47	B
May	65	6	25.6	.382	.44	B
June	23	3	8.6	.128	.14	C
July	20	2	5.2	.078	.09	C
August	26	2	6.2	.092	.11	C
September	355	4	35.8	.534	.60	B
October	203	12	24.0	.358	.41	B
November	330	12	58.6	.875	.98	B
December	458	14	72.9	1.09	1.26	B

OWASCO OUTLET NEAR AUBURN, N. Y. Fig. 1.
Submerged weir.

Monthly discharge of Keshequa Creek at Sonyea, N. Y., for 1912.
[Drainage area, 67 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
March	....	....	237	3.06	3.53	D
April	950	29	224	3.34	3.73	D
May	178	10	40.9	.610	.70	B
June	15	3	7.1	.106	.12	C
July	38	2	7.5	.112	.13	C
August	9	3	4.9	.073	.08	C
September	34	3	8.9	.133	.15	C
October	43	4	10.4	.155	.18	C
November	65	8	16.5	.246	.27	C
December	426	8	37.5	.560	.65	B

OWASCO OUTLET DRAINAGE BASIN.

Description.

Owasco lake is one of the Finger lake group in central New York and is generally rated as the sixth in size. It is about 11 miles long and has a maximum width of 1¼ miles. It has a water surface area of approximately 12.4 square miles and is drained by Owasco outlet.

The lake extends in a north and south direction and lies wholly within the boundaries of Cayuga county. The southern half of the lake, on both the east and west sides, is flanked by steep, sloping hills, rising to elevations of from 500 to 800 feet above the lake surface, which is at an elevation of 710 feet above tide water. These hills are rather deeply indented by numerous small streams, entering the lake at almost right angles from either side. To the south of the head of the lake and extending for some 17 or 18 miles is a rather narrow valley, the floor of which is about one-half mile in width at the lake and narrowing up as it approaches the southern extremity. This valley is drained by Owasco inlet which rises near Freeville in Tompkins county.

The dividing line for the drainage basin is at an elevation of from 700 to 1,300 feet above sea level on the west and attains an altitude of some 1,600 feet on the east. The western line falls about 2 miles back from the lake, while the eastern divide extends some 7 or 8 miles. The general shape of the drainage basin is long and narrow, the northern end terminating on the shores of Seneca river, into which the waters drain.

Owasco lake occupies about the center of the drainage basin north and south. From the foot of the lake north the descent is very rapid, there being 325 feet fall in the 17 miles between the outlet and Seneca river. One hundred and ten feet of this fall is practically within the city limits of Auburn and is utilized by the numerous manufacturing interests in that city. From a point just above Throopsville to Port Byron, a distance of about 5 miles, there is a fall of 130 feet, very little of which is developed. A State dam about one mile below the outlet of the lake practically controls the low and medium flow of this drainage. At Port Byron there is a small diverting dam owned by the State for the purpose of supplying water to the Erie canal.

The city of Auburn derives its water supply from Owasco lake and diverts an average of about 6,500,000 gallons daily. The drainage area is representative of the farming district in central New York and is fairly well timbered.

Owasco Outlet near Auburn, N. Y.

Location.— On the farm of George Ridley, 3¾ miles below the State dam at the outlet of Owasco lake, two miles below the center of the city of Auburn.

Records available.— November 17 to December 31, 1912.

Drainage area.— 206 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Gurley automatic water stage register installed over a concrete well 3½ feet square and 6 feet deep inside dimensions, and sheltered by a concrete house 5 x 6 feet, inside dimensions. The gage well is connected with the river by a 4-inch cast-iron pipe.

Channel.— The gage heights registered by this gage are controlled by a low concrete weir located a short distance below the gage. (See Fig. J.) This weir has a crest 1 foot wide and the slopes of both upstream and downstream faces are ½:1. A small horizontal apron was built on a level with the bed of the stream extending down stream 2½ feet from the toe of the dam. The left hand end of the dam for a distance of 50 feet has a mean elevation of gage height 1.28 feet. The remaining 50 feet of the crest of the dam is at gage height 2.12 feet.

Discharge measurements.— Made by wading directly opposite the gage in low water and from a cable and car at the same section in high water.

Winter flow.— It is hoped that ice will not form to a sufficient extent to clog any part of the control.

Accuracy.— Discharge measurements already made have been very consistent and estimates are excellent.

Co-operation.— Station installed and maintained in co-operation with the United States Geological Survey and the board of water commissioners, city of Auburn.

Diversions.—An average flow of about ten second feet is pumped from Owasco lake for the muncipal water supply of the city of Auburn. It is not known what proportion of this gets back into the stream above the gaging station. Investigations are under way that may determine this factor.

Discharge measurements of Owasco Outlet near Auburn, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 22	C. C. Covert	Misc.	111
Nov. 21 *a*	G. H. Canfield	2.53	319
22 *a*	do	2.53	318
23 *a*	do	2.73	418
24 *a*	do	1.88	79.3
24 *a*	do	*d* 2.14	147
28 *b*	do	1.46	9.7
28 *c*	do	1.44	8.4
30 *a*	do	2.75	436

a Made by wading at gage.
b Made by wading 60 feet below gage.
c Made by wading 200 feet below gage.
d At the time this measurement was made the low water section of the control was just full.

Daily gage height, in feet, of Owasco Outlet near Auburn, N. Y. for 1912.
[Gurley Automatic Gage.]

DAY.	Nov.	Dec.	DAY.	Nov.	Dec.
1	....	1.88	17	1.59	2.13
2	....	2.51	18	2.37	2.41
3	....	2.48	19	2.28	2.44
4	....	2.46	20	2.36	2.41
5	....	2.48	21	2.45	2.41
6	....	2.58	22	2.48	2.40
7	....	2.64	23	2.45	2.42
8	....	2.45	24	2.06	2.42
9	....	2.39	25	2.50	2.39
10	....	2.64	26	2.46	2.40
11	....	2.61	27	2.54	2.38
12	....	2.60	28	1.75	2.39
13	....	2.52	29	2.34	2.33
14	....	2.27	30	2.19	2.36
15	....	1.66	31	....	2.38
16	....	2.07			

NOTE — Mean daily gage height obtained by averaging hourly readings for each 24 hour period.

Daily discharge, in second-feet, of Owasco Outlet near Auburn, N. Y., for 1912.

DAY.	Nov.	Dec.	DAY.	Nov.	Dec.
1	....	*79.2	17	*26.5	144
2	....	308	18	241	259
3	....	293	19	202	273
4	....	283	20	237	259
5	....	293	21	278	259
6	....	343	22	293	*255
7	....	373	23	278	264
8	....	*278	24	*125	264
9	....	250	25	303	250
10	....	373	26	283	255
11	....	358	27	323	246
12	....	353	28	52.7	250
13	....	313	29	228	*223
14	....	198	30	166	237
15	....	*37.4	31	....	246
16	....	128			

NOTE.— Daily discharge determined from a well defined rating curve. Daily discharge considered to be within 2 per cent of the true mean.
* Sundays.

Monthly discharge of Owasco Outlet near Auburn, N. Y., for 1912.
[Drainage area, 206 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
November 17–30	323	*26.5	217	1.05	.55	A
December	373	*37.4	256	1.24	1.43	A

* Sunday.

SALMON RIVER DRAINAGE BASIN.

Description.

Salmon river rises in the southwestern part of Lewis county, N. Y., and flows southward and then northward, entering Lake Ontario near Port Ontario. Its drainage area comprises about 285 square miles. The topography is generally rolling in character, and the soil is sandy, rock lying near the surface in the upper part of the basin, where there are extensive tracts of virgin forest.

The mean annual precipitation is about 35 inches, and during the winter there is usually a heavy fall of snow, which often accumulates in the forest areas to a depth of several feet. The gradual melting of this snow, in the spring, tends to prevent high freshets.

The basin affords several opportunities for storage. At High Falls there is an undeveloped fall of about 110 feet, occurring in a very short distance. Considering its size, this river has rather important power possibilities.

A gaging station has been maintained in this river basin near Pulaski from 1900 to 1908 and from 1910 to 1912 inclusive, and at Stillwater near Altmar in 1911 and 1912.

Salmon River at Stillwater Bridge near Redfield, N. Y.

Location.— On Stillwater highway bridge 6¼ miles by road east of Altmar, one-fourth mile above the proposed dam of the Ontario Power Company, seven-eighths mile below Pennock Brook(coming in from the right) and 7 miles below the mouth of North Branch (coming in from the right).

Records available.— June 24, 1911, to December 31, 1912.

Drainage area.— 191 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Chain, attached to upstream side of bridge; datum unchanged since established.

Channel.— Small stone and gravel.

Discharge measurements.— Made from bridge or by wading.

Winter flow.— Relation of gage height to discharge affected by ice.

Accuracy.— Conditions for making measurements are good. Records should be excellent for the open water period.

Co-operation.— Station established by United States Geological Survey in co-operation with the Ontario Power Company of Niagara Falls, N. Y., and State of New York Conservation Commission.

Discharge measurements of Salmon river at Stillwater Bridge near Redfield, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
Feb. 25 a	Frank Weber	3.55	325
Mar. 13 a	C. S. De Golyer	b 2.81	205
April 16	do	c 9.76	7,040
18	do	d 7.89	4,430
Oct. 16	J. G. Mathers	2.65	312

a Measurement made under complete ice cover.
b Staff gage, 0.83.
c Staff gage, 4.88.
d Staff gage, 3.85.

Daily gage height, in feet, of Salmon River at Stillwater Bridge near Redfield, N. Y., for 1912.
[Ralph Lindner, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.6	......	......	5.3	5.2	4.4	1.72	1.57	1.68	4.8	2.75	2.2
2	3.5	......	......	5.4	5.1	3.8	1.7	1.55	1.72	4.9	2.95	3.6
3	3.4	......	......	5.1	5.0	4.0	1.70	1.74	1.68	3.8	2.8	7.4
4	3.2	......	......	4.8	4.6	3.7	1.7	1.82	1.86	4.4	2.65	5.9
5	3.7	......	......	4.5	4.3	3.3	1.95	1.76	1.79	4.2	2.5	4.7
6	3.6	......	......	5.8	4.5	3.0	1.84	1.71	2.35	3.3	2.5	5.2
7	3.3	......	3.0	7.6	4.7	2.9	1.76	1.62	2.05	2.95	3.2	5.7
8	3.4	......	......	8.2	4.2	2.65	1.7	1.61	1.98	2.65	5.7	4.6
9	3.3	......	......	7.0	4.0	2.5	1.69	1.59	1.86	2.5	5.4	3.8
10	3.5	......	......	5.9	3.8	2.4	1.64	1.93	1.92	2.7	4.6	3.7
11	3.6	......	......	5.5	3.5	2.3	1.62	2.5	2.35	2.8	3.9	3.4
12	3.4	......	......	5.0	3.5	2.25	1.62	2.25	2.65	2.75	3.5	3.5
13	3.2	......	2.8	5.1	4.3	2.3	1.62	2.1	2.2	3.7	3.4	3.6
14	......	......	2.8	6.4	4.3	2.25	1.77	2.0	2.0	3.3	4.6	3.6
15	......	......	3.0	9.0	3.9	2.15	1.7	1.98	1.98	2.95	4.6	3.4
16	......	......	3.8	10.0	3.7	2.2	1.92	1.82	4.0	2.65	4.2	3.4
17	......	......	3.9	9.8	5.0	2.9	1.72	1.74	2.95	2.5	3.5	3.2
18	......	......	4.3	7.9	5.5	2.55	1.64	1.74	2.5	2.4	3.3	3.1
19	......	......	4.4	8.1	4.3	2.3	1.67	1.8	2.75	2.8	3.0	4.0
20	......	......	4.5	6.2	3.9	2.15	1.64	1.77	2.45	3.4	3.0	4.8
21	......	......	4.2	5.9	6.1	2.1	1.76	1.74	2.4	3.0	3.1	4.5
22	......	......	4.2	7.0	6.4	2.05	2.35	1.84	2.35	2.7	3.3	4.2
23	......	......	4.0	10.1	5.3	1.98	1.95	1.82	2.5	3.1	3.3	3.9
24	......	......	3.9	7.0	4.3	1.92	1.8	1.85	4.7	4.2	3.2	3.7
25	......	3.55	3.7	5.8	4.2	1.88	1.68	1.86	4.8	5.4	3.2	3.4
26	......	......	3.3	6.2	3.6	1.84	1.66	1.88	4.2	5.0	3.1	3.7
27	......	......	3.4	7.0	3.2	1.80	1.66	2.25	3.4	4.6	3.0	3.4
28	......	......	3.6	6.8	3.0	1.78	1.63	2.05	2.85	3.9	2.8	3.0
29	......	3.4	4.2	5.6	5.7	1.78	1.6	1.87	3.2	3.4	2.6	3.0
30	......	......	5.0	5.0	6.6	1.75	1.6	1.76	2.8	3.0	2.4	3.3
31	......	......	5.0	......	5.5	......	1.57	1.68	......	2.8	......	3.9

NOTE.— Relation of ga affected by ice January 5 to April 4.

Daily discharge, in second-feet, of Salmon River at Stillwater Bridge near Redfield, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	598	......	......	514	1,440	935	99	72	91	1,160	340	200
2	564	......	......	532	1,360	672	95	68	99	1,220	396	598
3	532	......	......	690	1,290	754	95	103	91	672	353	3,780
4	469	......	......	840	1,040	634	95	118	126	935	313	2,050
5	......	......	......	985	885	500	144	106	112	840	274	1,100
6	......	......	......	1,960	985	410	122	97	236	500	274	1,440
7	......	......	235	4,040	1,100	381	106	81	166	396	469	1,870
8	......	......	......	4,860	840	313	95	79	151	313	1,870	1,040
9	......	......	......	3,260	754	274	93	75	126	274	1,600	672
10	......	......	......	2,050	672	249	84	140	138	326	1,040	634
11	......	......	......	1,690	564	224	81	274	236	353	712	532
12	......	......	......	1,290	564	212	81	212	313	340	564	564
13	......	......	205	1,360	885	224	81	177	200	634	532	598
14	......	......	......	2,560	885	212	108	155	155	500	1,040	598
15	......	......	......	5,980	712	188	95	151	151	396	1,040	532
16	......	......	......	7,380	634	200	138	118	754	313	840	532
17	......	......	......	7,100	1,290	381	99	103	396	274	564	469
18	......	......	......	4,440	1,690	287	84	103	274	249	500	439
19	......	......	......	4,720	885	224	90	114	340	353	410	754
20	......	......	......	2,350	712	188	84	108	262	532	410	1,160
21	......	......	......	2,050	2,250	177	106	103	249	410	439	985
22	......	......	......	3,260	2,560	166	236	122	236	326	500	840
23	......	......	......	7,520	1,520	151	144	118	274	439	500	712
24	......	......	......	3,260	885	138	114	124	1,100	840	469	634
25	......	325	......	1,960	840	130	91	126	1,160	1,600	469	532
26	......	......	......	2,350	598	122	88	130	840	1,290	439	634
27	......	......	......	3,260	469	114	88	212	532	1,040	410	532
28	......	......	......	3,020	410	110	82	166	367	381	353	410
29	......	300	......	1,780	1,870	110	77	128	469	249	300	410
30	......	......	......	1,290	2,780	104	77	106	353	410	249	500
31	......	......	......	......	1,690	......	72	91	......	353	......	712

NOTE.— Daily discharge determined from a well defined rating curve.
Discharge April 1 to 4, determined from a rating curve based on measurements made with ice present.

Monthly discharge of Salmon River at Stillwater Bridge or near Redfield, N. Y.
[Drainage area, 191 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	250	1.31	1.51	C
February	....	....	200	1.05	1.13	C
March	....	....	323	1.69	1.95	C
April	7,520	514	2,950	15.4	17.18	A
May	2,750	410	1,130	5.92	6.82	A
June	935	104	293	1.53	1.71	A
July	236	72	101	.529	.61	B
August	274	68	125	.654	.75	B
September	1,160	91	333	1.74	1.94	A
October	1,600	249	578	3.03	3.49	A
November	1,870	249	589	3.08	3.43	A
December	3,780	200	854	4.47	5.15	A
The year	7,520	68	642	3.36	45.67	......

NOTE.— Discharge January 5 to April 4 determined by means of a curve applicable to flow under ice cover, and climatologic records.
Mean discharge, January 5 to 31, estimated 135 second-feet.

Salmon River at Fox's Bridge near Pulaski, N. Y.

Location.— At a highway bridge known locally as Fox's Bridge, about 2½ miles above the village of Pulaski, 2¼ miles above Trout Brook (coming in from the left) and 6½ miles above the mouth of the river.

Records available.— September 5, 1900, to June, 30, 1907; August 16, to December 6, 1908; July 14 to December 31, 1910, and April 1, 1911 to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and surveyor, State of New York.

Drainage area.— *260 square miles. (From U. S. G. S. Topographic Sheets.)

Gage.—A vertical staff attached to the upstream end of the center pier of the bridge was read from September 5, 1900, to the winter of 1901–02, when it was destroyed by ice. On July 23, 1902, a chain gage was installed the zero of which is 1.20 feet below the original staff gage zero. Datum of chain gage unchanged since established.

Channel.— Gravel; fairly permanent.

Discharge measurements.— Made either by wading or from the bridge.

Winter flow.— Relation to gage height to discharge affected by ice.

Accuracy.— Open water curve well developed. Published data considered good.

Co-operation.— Maintained in co-operation with the New York State Engineer and Surveyor prior to 1910, in co-operation with the State of New York Conservation Commission beginning July 14, 1910.

* Drainage area changed to present figure on basis of more accurate determination.

Discharge measurements of Salmon River at Fox's Bridge near Pulaski, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec. ft.*
April 13	C. S. De Golyer	4.78	2,050
17	do	7.45	9,430
Oct. 18	J. G. Mathers	3.00	314

Daily gage height, in feet, of Salmon River at Fox's Bridge, near Pulaski, N. Y., for 1912.
[Seymour J. Fox, observer.]

DAY.	Jan.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.45	6.6	4.6	4.35	2.6	2.4	2.5	4.5	3.22	3.15
2	3.45	5.2	4.5	3.9	2.58	2.4	2.5	4.45	3.22	3.42
3	3.35	4.9	4.5	3.85	2.58	2.6	2.5	3.9	3.25	5.9
4	3.15	4.4	4.3	3.9	2.55	2.62	2.6	4.0	3.15	5.2
5	3.1	4.5	4.1	3.65	2.6	2.55	2.6	4.1	3.15	4.5
6	3.0	5.4	4.15	3.45	2.65	2.5	3.02	3.6	3.05	4.3
7	......	6.6	4.25	3.38	2.58	2.48	3.0	3.35	3.22	4.9
8	......	6.9	4.05	3.28	2.6	2.42	2.8	3.25	5.1	4.3
9	......	5.9	3.9	3.18	2.55	2.4	2.65	3.1	4.8	3.6
10	......	5.4	3.75	3.05	2.5	2.48	2.58	3.15	4.4	3.6
11	......	5.2	3.6	3.0	2.5	3.12	2.85	3.25	4.0	3.45
12	......	4.75	3.55	3.02	2.5	2.9	3.25	3.2	3.75	3.3
13	......	4.85	4.05	3.05	2.48	2.75	2.95	3.6	3.6	3.4
14	......	5.5	4.05	3.0	2.5	2.75	2.8	3.55	4.2	3.55
15	......	7.0	3.85	2.9	2.55	2.72	2.8	3.32	4.5	3.55
16	......	7.5	3.75	2.92	2.68	2.6	3.65	3.18	4.1	3.5
17	......	7.2	4.5	3.3	2.62	2.52	3.38	3.05	3.75	3.38
18	......	6.3	4.8	3.10	2.52	2.42	3.08	2.95	3.65	3.4
19	......	6.5	4.2	3.02	2.5	2.5	3.02	3.05	3.4	4.0
20	......	5.6	3.9	2.95	2.48	2.52	3.05	3.48	3.45	4.2
21	......	5.3	5.1	2.9	2.52	2.5	3.0	3.3	3.5	4.15
22	......	5.9	5.7	2.82	2.9	2.5	2.95	3.15	3.5	3.95
23	......	7.4	4.6	2.8	2.75	2.5	2.92	3.12	3.55	3.8
24	......	6.0	4.2	2.75	2.6	2.58	4.1	3.9	3.5	3.8
25	......	5.2	4.05	2.72	2.5	2.6	4.3	4.5	3.6	3.5
26	......	5.3	3.8	2.68	2.5	2.68	4.1	4.4	3.5	3.4
27	......	5.6	3.55	2.65	2.5	2.7	3.7	4.2	3.5	3.4
28	......	5.6	3.4	2.65	2.42	2.7	3.32	3.95	3.4	3.36
29	......	4.9	4.9	2.65	2.42	2.65	3.2	3.5	3.28	3.28
30	......	4.6	5.6	2.6	2.4	2.6	3.5	3.38	3.35	3.38
31	......	......	5.2	......	2.4	2.6	......	3.22	......	3.83

NOTE.— Relation of gage height to discharge affected by ice January 7 to April 1.

Daily discharge, in second-feet, of Salmon River, at Fox's Bridge, near Pulaski, N. Y., for 1912.

DAY.	Jan.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	642	13,000	1,800	1,500	152	88	118	1,680	479	432
2	642	2,750	1,680	1,020	145	88	118	1,620	479	620
3	570	2,240	1,680	978	145	152	118	1,020	500	4,250
4	432	1,560	1,440	1,020	135	160	152	1,120	432	2,750
5	400	1,680	1,220	802	152	135	152	1,220	432	1,680
6	340	3,140	1,280	642	172	118	352	760	370	1,440
7	......	6,330	1,380	591	145	112	340	570	479	2,240
8	......	7,380	1,170	521	152	94	235	500	2,570	1,440
9	......	4,250	1,020	452	135	88	172	400	2,090	760
10	......	3,140	888	370	118	112	145	432	1,560	760
11	......	2,750	760	340	118	413	260	500	1,120	642
12	......	2,020	720	352	118	285	500	465	888	535
13	......	2,160	1,170	370	112	213	312	760	760	605
14	......	3,340	1,170	340	118	213	235	720	1,330	720
15	......	7,750	978	285	135	200	235	549	1,680	720
16	......	9,660	888	296	183	152	802	452	1,220	680
17	......	8,500	1,680	535	160	125	591	370	888	591
18	......	5,370	2,090	400	125	94	388	312	802	605
19	......	6,000	1,330	352	118	118	352	370	605	1,120
20	......	3,550	1,020	312	112	125	370	665	642	1,330
21	......	2,940	2,570	285	125	118	340	535	680	1,280
22	......	4,250	3,770	245	285	118	312	432	680	1,070
23	......	9,270	1,800	235	213	118	296	413	720	930
24	......	4,510	1,330	213	152	145	1,220	1,020	680	930
25	......	2,750	1,170	200	118	152	1,440	1,680	760	680
26	......	2,940	930	183	118	183	1,220	1,560	680	605
27	......	3,550	720	172	118	191	845	1,330	680	605
28	......	3,550	605	172	94	191	549	1,070	605	577
29	......	2,240	2,240	172	94	172	465	680	521	521
30	......	1,800	3,550	152	88	152	680	591	570	591
31	......	......	2,750	......	88	152	......	479	......	958

NOTE.— Daily discharge determined from a well defined rating curve. Discharge April 1st, estimated.

Monthly discharge of Salmon River at Fox's Bridge near Pulaski, N. Y., for 1912.
[Drainage area 260 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	340	1.31	1.51	C
February	....	....	270	1.04	1.12	C
March	....	....	440	1.69	1.95	C
April	9,660	1,560	4,150	16.0	17.85	B
May	3,770	605	1,510	5.81	6.70	B
June	1,500	152	450	1.73	1.93	B
July	285	88	137	.527	.61	B
August	413	88	154	.592	.68	B
September	1,440	118	444	1.71	1.91	B
October	1,680	312	783	3.01	3.47	B
November	2,570	370	863	3.32	3.70	B
December	4,250	432	1,050	4.04	4.66	B
The year	9,660	88	879	3.38	46.09	

NOTE.— Discharge January 7 to April 1, estimated from the discharge at Stillwater bridge. Mean discharge, January 7 to 31, estimated 300 second-feet.

Orwell Brook near Altmar, N. Y.

Location.— At highway bridge 1½ miles by road northwest of Altmar and one-eighth mile above confluence with Salmon river.

Records available.— June 23, 1911, to December 31, 1912. Data also in annual reports of United States Geological Survey.

Drainage area.— 22.1 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Standard chain, attached to downstream side of bridge.

Channel.— Curved above the bridge and current rather swift. Bed composed of small stone and gravel; two channels above bridge, but one at gage.

Discharge measurements.— Made by wading at low stages, from bridge at high stages.

Winter flow.— Relation of gage height to discharge affected by ice.

Accuracy.— The discharge rating curve has been fairly well developed. Estimates good.

Co-operation.— Established by United States Geological Survey in co-operation with the Ontario Power Company of Niagara Falls and State of New York Conservation Commission.

Discharge measurements of Orwell Brook, near Altmar, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
April 13	C. S. DeGolyer	3.54	204
17	do	3.96	282
Oct. 16	J. G. Mathers	2.13	26.1

Daily gage height, in feet, of Orwell Brook near Altmar, N. Y., for 1912.
[Mrs. A. G. White, observer.]

DAY.	Jan.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.44	......	3.7	2.48	2.65	1.91	1.9	1.98	3.2	2.25	2.35
2	2.37	......	3.75	2.42	2.5	1.9	1.9	1.99	2.68	2.25	3.15
3	2.3	......	3.4	2.38	2.62	1.89	2.12	2.0	2.42	2.2	3.6
4	2.44	......	3.2	2.34	2.51	1.9	2.02	1.98	2.6	2.18	2.85
5	2.65	......	3.45	2.29	2.45	1.9	2.0	2.29	2.42	2.18	2.64
6	3.2	......	4.4	2.38	2.35	1.89	1.98	1.98	2.32	2.18	2.7
7	3.35	......	5.1	2.4	2.29	1.85	1.95	1.96	2.24	2.48	2.7
8	3.1	......	4.7	2.34	2.24	1.85	1.95	1.95	2.18	3.1	2.58
9	3.25	......	4.0	2.34	2.2	1.85	1.95	1.95	2.12	2.98	2.4
10	3.25	......	3.75	2.32	2.16	1.84	2.02	2.02	2.2	2.69	2.45
11	3.2	......	3.55	2.28	2.15	1.85	2.1	2.25	2.2	2.48	2.35
12	3.1	......	3.4	2.32	2.15	1.85	2.02	2.2	2.25	2.4	2.38
13	......	......	3.65	2.5	2.14	1.82	2.0	2.12	2.32	2.4	3.0
14	......	3.95	4.1	2.48	2.12	1.91	2.1	2.04	2.22	3.15	2.73
15	......	3.85	4.9	2.38	2.09	1.85	2.02	2.16	2.18	3.05	2.63
16	......	3.65	4.7	2.48	2.14	1.88	2.0	2.32	2.14	2.68	2.6
17	......	2.65	4.2	2.82	2.35	1.82	1.98	2.18	2.12	2.55	2.53
18	......	2.8	2.55	2.72	2.18	1.82	2.0	2.2	2.2	2.55	2.33
19	......	2.88	3.7	2.51	2.1	1.82	2.08	2.22	2.22	2.4	3.1
20	......	2.9	3.1	2.46	2.1	1.82	2.01	2.12	2.2	2.4	2.78
21	......	2.95	2.99	3.45	2.09	1.98	1.98	2.08	2.15	2.38	2.7
22	......	2.95	3.2	3.3	2.04	2.0	1.98	2.05	2.15	2.35	2.62
23	......	2.86	4.0	2.7	2.0	1.92	1.98	2.3	2.15	2.35	2.55
24	......	2.62	3.3	2.68	2.0	1.9	2.0	2.52	2.4	2.38	2.55
25	......	2.55	2.98	2.59	2.0	1.84	2.0	2.72	2.78	2.4	2.5
26	......	2.46	2.79	2.44	1.96	1.86	2.0	2.45	2.75	2.45	2.45
27	......	2.46	2.72	2.34	1.95	1.85	2.15	2.32	2.7	2.42	2.38
28	......	2.58	2.62	2.29	1.95	1.82	2.12	2.22	2.52	2.34	2.3
29	......	3.0	2.61	3.5	1.95	1.85	2.02	2.22	2.44	2.31	2.43
30	......	3.45	2.58	3.32	1.92	1.85	2.0	2.0	2.32	2.35	2.4
31	......	3.5	......	2.98	......	1.86	1.98	......	2.25	......	2.65

NOTE.— Relation of gage height to discharge affected by ice January 13, to some time in March.

Daily discharge, in second-feet, of Orwell Brook near Altmar, N. Y., for 1912.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	232	54	72	13	13	16	149	34	42
2	241	49	56	13	13	17	76	34	142
3	181	45	68	13	24	17	49	30	215
4	149	42	57	13	18	16	66	29	98
5	190	37	52	13	17	37	49	29	71
6	368	45	42	13	16	16	40	29	78
7	520	47	37	11	15	15	33	53	78
8	431	42	33	11	15	15	29	134	64
9	288	42	30	11	15	15	24	116	47
10	241	40	27	11	18	18	30	77	52
11	406	36	26	11	23	34	30	54	42
12	181	40	26	11	18	30	34	47	45
13	224	56	26	10	17	24	40	47	119
14	307	54	24	13	23	19	32	142	81
15	475	45	22	11	18	27	29	126	68
16	431	54	26	12	17	40	26	76	66
17	327	94	42	10	16	29	24	61	58
18	206	81	29	10	17	30	30	61	40
19	232	57	23	10	22	32	32	47	134
20	134	52	23	10	18	24	30	47	88
21	118	190	22	16	16	22	26	45	78
22	149	165	19	17	16	20	26	42	68
23	288	78	17	14	16	38	26	42	61
24	165	76	17	13	17	58	47	45	61
25	116	65	17	11	17	81	88	47	56
26	90	51	15	11	17	52	84	52	52
27	81	42	15	11	26	40	78	49	45
28	68	37	15	10	24	32	58	42	38
29	67	198	15	11	18	32	51	39	54
30	64	168	14	11	17	17	40	42	47
31	......	116	......	11	16	......	34	......	72

NOTE.— Daily discharge determined from a well defined rating curve.

Monthly discharge of Orwell Brook near Altmar, N. Y., for 1912.

[Drainage area, 22.1 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
April	520	64	232.	10.5	11.71	B
May	198	36	70.9	3.21	3.70	A
June	72	14	30.2	1.37	1.53	B
July	17	10	11.8	.539	.62	B
August	26	13	17.8	.813	.94	B
September	81	15	28.8	1.32	1.47	B
October	149	24	45.5	2.06	2.38	A
November	142	29	57.3	2.59	2.89	A
December	215	38	72.9	3.30	3.80	A

BLACK RIVER DRAINAGE BASIN.

Description.

Black river rises in the western part of Hamilton county, N. Y., flows southwestward across Herkimer county into Oneida county, turns near Forestport and runs somewhat west of north through Lewis county to eastern Jefferson county, and then flows westward to Black River bay, at the eastern extremity of Lake Ontario. Its total drainage area is 1,930 square miles. The upper part of the basin is very rugged and mountainous, contains a large number of lakes, and is in a part of the Adirondack forest.

The mean annual precipitation is about 40 inches, ranging from 55 inches in the extreme headwaters to perhaps 30 inches near Lake Erie. The winters are generally quite severe, and the stream flow is affected by ice for periods of several months.

The regimen of the river is controlled by storage on its upper tributaries (including Beaver river at Beaver), a series of reservoirs at the headwaters of Moose river, and additional reservoirs at Forestport and on the headwaters of the main river.

Water is diverted from Black river through Forestport feeder to supply the Black River canal at Boonville. A portion of this diverted water flows northward from Boonville and enters Black river again at Lyons Falls; the remainder flows southward through the Black River canal and enters the Erie canal at Rome.

Black River near Boonville, N. Y.

Location.— At highway bridge 2 or 3 miles northeast of Boonville, an equal distance by river downstream from Hawkinsville, and about 1 mile above the mouth of Sugar river, a small tributary from the left.

Records available.— February 16, 1911, to December 31, 1912; data also in annual reports of the United States Geological Survey.

Drainage area.— 303 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Standard chain, fastened to the downstream side of the bridge. A staff gage, reading from 6 to 13 feet, is fastened to the downstream right-hand abutment and is used for high water readings.

Channel.— Rough and bouldery; permanent.

Discharge measurements.— At high stages from a cable about one-quarter mile above the gage; at low stages, by wading near the cable section.

Winter flow.— Relation of gage height to discharge affected by ice.

Accuracy.— A well-defined discharge rating curve has been developed. The records do not give the total discharge of the drainage area. See Diversions.

Diversions.— A portion of the flow of Black river is diverted past the gaging station through a feeder having its intake at the State dam at Forestport and delivering its flow to the summit level of Black River canal at Boonville. A portion of the flow passes northward, supplying the Black River canal from Boonville to the head of slack water navigation at the foot of Lyons Falls. The remainder is diverted from the drainage basin and flows into the Erie canal at Rome. To determine the amount diverted past the station and out of the drainage basin measurements are made in the Forestport feeder at a farm bridge near Speny Hill, one mile northeast of Boonville. Measurements of northward flow in Black River canal are made at a farm bridge one-half mile north of Boonville; measurements of the southward flow at a farm bridge about three-fourths mile southeast from Boonville.

The Forestport feeder is open for service about May 1st for the purpose of feeding the Erie Canal which opens about May 15th, although the Black River Canal does not open until later. When navigation is closed on the Erie Canal the feeder gates are closed also and the surplus water runs over the dam into Black River. Some water leaks through the feeder gates

and flows through the feeder into Lansing Kill and Mohawk River.* Results of measurements made at this place in the past are published in reports of the State Engineer and Surveyor of New York.

Storage.— A reservoir built by the State at Forestport, about 8 miles upstream, stores about 2,000,000,000 cubic feet. About a mile above the station is a site at which a dam 110 feet high would impound 5,300,000,000 cubic feet of water.

Discharge measurements of Black River near Boonville, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb 3 *a*....	G. H. Canfield	5.66	354
15 *b*....	F. Weber	5.03	255
April 15.....	C. S. De Goyler	8.67	3,560
15.....	do	8.93	4,060
22.....	do	8.00	2,750
May 21.....	Frank Weber	7.15	1,970
July 26 *c*....	G. J. Lyon	3.32	55.1
28 *c*....	do	3.27	46.2
Oct. 27 *d*....	J. G. Mathers	5.35	544

a Measurement made under complete ice cover at cable.
b Measurement made at wading section 200 above bridge under complete ice cover.
c Made by wading 100 feet below cable.
d Made by wading 1,000 feet above bridge.

Daily gage height, in feet, of Black River near Boonville, N. Y., for 1912.
[W. D. Charbonneau, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.8	5.8	5.6	6.7	7.3	7.5	3.52	3.28	3.18	4.45	4.55	4.7
2.....	5.5	5.65	5.6	6.8	7.6	6.8	3.42	3.28	3.32	5.35	4.9	5.25
3.....	5.4	5.7	5.5	7.0	7.6	6.2	3.35	3.32	3.72	5.45	5.45	6.4
4.....	5.3	5.65	5.6	7.2	7.3	6.0	3.48	3.32	3.72	5.5	5.6	7.0
5.....	5.3	5.5	5.3	7.1	6.7	6.6	3.42	3.38	3.7	5.35	5.55	6.4
6.....	4.95	5.4	5.25	7.3	6.2	5.9	3.32	3.28	3.7	4.95	5.4	6.2
7.....	5.0	5.5	5.2	8.0	6.1	5.4	3.38	3.26	3.52	4.7	5.45	6.3
8.....	5.45	5.45	5.3	8.7	6.2	4.95	3.48	3.28	3.56	4.6	6.2	6.2
9.....	5.3	5.2	5.2	8.6	6.2	4.6	3.4	3.28	3.48	4.5	6.8	6.3
10.....	5.9	5.35	5.25	7.8	6.0	4.32	3.42	3.35	3.4	4.7	6.5	6.0
11.....	6.0	5.25	5.2	7.2	5.7	4.25	3.32	3.38	3.42	4.6	6.4	5.6
12.....	6.1	5.2	5.15	6.9	5.55	4.22	3.38	3.38	3.42	4.5	6.2	5.65
13.....	6.2	5.15	5.1	6.8	5.55	4.12	3.32	3.38	3.28	4.6	5.4	5.55
14.....	6.3	5.1	5.15	7.1	6.2	4.18	3.32	3.32	3.26	4.4	5.7	5.5
15.....	6.4	5.0	5.5	8.7	6.1	4.22	3.32	3.39	3.62	4.5	5.55	5.3
16.....	6.0	5.0	7.6	9.9	5.9	3.92	3.28	3.48	5.15	4.48	4.7	5.25
17.....	6.3	5.2	8.3	10.4	6.4	3.72	3.32	3.35	5.3	4.42	4.95	5.3
18.....	6.3	5.2	9.3	9.7	6.2	3.67	3.32	3.32	5.2	4.22	5.35	5.35
19.....	6.4	5.3	8.8	9.2	6.1	3.58	3.38	3.38	5.0	4.1	5.7	6.2
20.....	6.5	5.5	8.1	8.3	6.1	3.42	3.32	3.3	5.1	4.45	5.6	6.3
21.....	6.4	6.0	7.7	8.0	7.2	3.32	3.45	3.22	5.0	4.6	5.6	6.4
22.....	6.5	6.4	7.0	8.1	7.8	3.18	3.65	3.22	5.0	4.48	5.6	5.8
23.....	6.3	6.2	6.9	9.9	7.4	3.3	3.68	3.32	4.9	4.44	5.6	5.6
24.....	5.9	6.2	6.6	9.2	7.0	3.42	3.55	3.35	4.95	4.6	6.6	5.65
25.....	5.65	6.3	6.5	8.3	6.4	3.58	3.42	3.32	5.25	5.0	5.5	5.8
26.....	5.5	6.2	6.3	7.8	6.2	3.52	3.32	3.38	5.45	5.4	5.55	5.5
27.....	5.5	6.4	6.0	7.8	6.2	3.72	3.22	3.28	5.3	5.4	5.4	5.3
28.....	5.6	6.1	6.1	8.1	6.1	3.62	3.22	3.28	5.35	5.2	5.15	5.4
29.....	5.6	5.7	6.2	7.7	6.5	3.52	3.32	3.22	5.1	5.0	5.0	5.15
30.....	5.9	......	6.3	7.2	8.1	3.58	3.22	3.12	4.75	4.7	4.9	5.3
31.....	5.8	......	6.6	......	8.1	......	3.18	3.22	......	4.6	......	5.7

NOTE.— Relation of gage height to discharge affected by ice January 8th to March 19th
* Former figure for drainage area determined from less accurate maps.

Daily discharge, in second-feet, of Black River near Boonville, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	795	373	341	1,460	2,050	2,270	74	49	40	238	262	305
2......	630	349	341	1,540	2,380	1,540	63	49	53	558	370	512
3......	580	357	325	1,740	2,380	1,060	56	53	100	605	605	1,210
4......	535	349	341	1,940	2,050	920	70	53	100	630	680	1,740
5......	535	325	295	1,840	1,460	1,370	63	59	97	558	655	1,210
6......	390	310	288	2,050	1,060	855	53	49	97	390	580	1,060
7......	410	325	280	2,860	990	580	59	47	74	305	605	1,140
8......	520	318	295	3,750	1,060	390	70	49	79	275	1,060	1,060
9......	430	280	280	3,620	1,060	275	61	49	70	250	1,540	1,140
10......	570	302	288	2,620	920	209	63	56	61	305	1,290	920
11......	550	288	280	1,940	735	194	53	59	63	275	1,210	680
12......	540	280	272	1,640	655	188	59	59	63	250	1,060	708
13......	530	272	265	1,540	655	168	53	59	49	275	580	655
14......	520	265	272	1,840	1,060	180	53	53	47	227	735	630
15......	520	250	325	3,750	990	188	53	60	87	250	655	535
16......	420	250	856	5,380	855	131	49	70	470	245	305	512
17......	456	280	1,390	6,100	1,210	100	53	56	535	232	390	535
18......	456	280	1,920	5,100	1,060	93	53	53	490	188	558	558
19......	473	295	2,450	4,410	990	82	59	59	410	164	735	1,060
20......	490	325	2,980	3,240	990	63	53	51	450	238	680	1,140
21......	473	405	2,500	2,860	1,940	53	66	44	410	275	680	1,210
22......	490	473	1,740	2,980	2,620	40	90	44	410	245	680	795
23......	456	439	1,640	5,380	2,160	51	94	53	370	236	680	680
24......	389	439	1,370	4,410	1,740	63	78	56	390	275	680	708
25......	349	456	1,290	3,240	1,210	82	63	53	512	410	630	795
26......	325	439	1,140	2,620	1,060	74	53	59	605	580	655	630
27......	325	473	920	2,620	1,060	100	44	49	535	580	580	535
28......	341	422	990	2,980	990	87	44	49	558	490	470	580
29......	341	357	1,060	2,500	1,290	74	53	44	450	410	410	470
30......	389	......	1,140	1,940	2,980	82	44	36	320	305	370	535
31......	373	......	1,370	......	2,980	......	40	44	......	275	......	735

NOTE.— Daily discharge, January 1st to 7th, determined from a rating curve fairly well defined below discharge 4,100 second-feet. Daily discharge January 17th to March 15th determined from a rating curve based on two measurements made under ice conditions. Daily discharge January 8th to 16th and March 16th to 19th estimated by making a gradual change between the open water and ice curves.

For diversion see paragraph in station description.

Monthly discharge of Black River near Boonville, N. Y., for 1912.

[Drainage area, 303 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January....................	795	325	471.	1.55	1.79	C
February....................	473	250	344.	1.14	1.23	C
March....................	2,980	265	943.	3.11	3.58	C
April....................	6,100	1,460	3,000.	9.90	11.04	A
May....................	2,980	655	1,440.	4.75	5.48	A
June....................	2,270	40	385.	1.27	1.42	A
July....................	94	40	59.3	.196	.23	A
August....................	70	36	52.	.172	.20	A
September....................	605	40	266.	.878	.98	A
October....................	630	164	340.	1.12	1.29	A
November....................	1,540	262	680.	2.24	2.50	A
December....................	1,740	305	806.	2.66	3.07	A
The year...............	6,100	36	730.	2.41	32.81	

Moose River at Moose River, N. Y.

Location.— In the village of Moose river, about three miles down stream from McKeever station on the Adirondack division of the New York Central railroad, five miles below the mouth of south branch of Moose river (coming in from left) and nearly twenty miles above the junction of Black and Moose rivers at Lyons Falls.

Records available.— June 5, 1900, to December 31, 1912. Data also in annual reports of the United States Geologocial Survey, State Engineer and Surveyor and State Water Supply Commission of New York.

Drainage area.— 370 sq. miles.* (From U. S. G. S. Topographic sheets.)

Gage.— Staff, in two sections, fastened to the left bank a short distance above cable; read twice daily. The elevation of the gage zero was changed February 28, 1903, from 15.36 to 15.53.

Channel.— Composed of cobble and boulders; fairly permanent; current smooth; depth comparatively uniform; just above the station is a small island upon which ice and log jams occasionally form. Velocity from dam at McKeever to the station relatively slow; below the station velocity very high.

Discharge measurements.— Made from cable erected July, 1903. Cable has a clear span of 269 feet.

Artificial control.— A timber dam at McKeever is used for power and for the regulation of flow for log driving. During portions of the year, therefore, two gage readings a day may not give a representative mean.

Winter flow.— The stream freezes over in winter and is covered with alternate layers of ice and snow which render the determination of discharge difficult.

Accuracy.— Discharge rating curve for open channel fairly accurate. Published discharge data for periods of open water considered good.

Co-operation.— Established by the United States Geological Survey and maintained in co-operation with the New York State Engineer and Surveyor.

* Drainage area revised on basis of new topographic sheets.

Discharge measurements of Moose River at Moose River, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 16 *a*	Frank Weber	1.90	310
17 *a*	do	2.36	403
April 20 *b*	C. S. De Golyer	6.0	3,710
20	do	5.75	3,930
Oct. 25	Frank Weber	4.2	2,120

a Measurements made under complete ice cover.
b Results doubtful owing to logs interfering with work. Probably backwater effect.

Daily gage height, in feet, of Moose River at Moose River, N. Y., for 1912.
[Chris Hannon, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	3.0	......	......	......	4.6	4.4	0.6	0.8	0.25	1.6	3.0	1.8
2......	2.8	......	2.6	......	4.3	3.8	0.9	0.7	0.65	1.8	3.6	2.8
3......	2.7	0.9	......	......	4.6	3.3	0.6	0.9	1.15	1.9	3.4	4.1
4......	2.6	......	......	......	4.4	3.0	0.0	0.9	1.1	2.0	3.2	4.0
5......	2.4	......	......	......	4.2	2.6	0.5	0.8	0.95	1.6	2.8	3.4
6......	2.2	......	......	3.9	4.0	2.3	0.55	0.9	0.9	1.6	2.5	2.8
7......	2.0	......	......	......	3.8	2.4	0.65	0.8	1.05	1.45	3.5	2.4
8......	2.4	......	......	......	3.8	2.2	0.75	0.8	1.0	1.4	4.9	2.0
9......	2.6	......	2.5	......	3.6	2.0	0.8	0.7	1.1	1.3	4.7	1.7
10......	2.5	0.8	......	......	3.2	2.0	0.7	0.7	1.0	1.4	4.1	1.6
11......	2.5	......	......	......	3.0	1.9	0.7	0.8	0.9	1.5	3.1	1.6
12......	2.4	......	......	......	3.0	1.7	0.6	0.8	0.85	1.6	2.8	1.8
13......	2.6	......	......	2.6	2.9	1.5	0.5	0.8	0.0	1.8	2.4	1.9
14......	2.7	......	......	3.0	3.0	1.2	0.0	0.75	0.6	2.0	2.2	2.0
15......	......	......	......	4.6	2.9	0.85	0.5	0.9	0.95	2.0	2.8	2.2
16......	......	1.9	3.0	7.8	2.9	0.0	0.65	0.8	1.4	2.0	2.8	2.4
17......	......	2.2	......	8.5	3.5	1.05	0.7	0.7	1.8	1.9	2.4	2.4
18......	......	......	......	7.5	3.8	1.1	0.8	0.9	1.6	1.8	2.0	2.2
19......	......	......	......	6.7	3.8	1.35	0.8	0.8	1.6	1.8	2.0	1.9
20......	2.2	......	......	5.6	4.1	1.3	0.8	0.65	1.45	1.9	2.0	1.8
21......	......	......	......	5.4	4.6	1.25	0.75	0.5	1.35	1.8	2.0	1.8
22......	......	......	......	5.7	5.0	0.95	0.95	0.0	1.45	2.0	2.0	2.2
23......	......	......	3.1	9.0	4.8	1.05	0.9	0.6	1.8	2.0	2.0	2.4
24......	......	2.3	......	6.4	4.4	1.0	0.9	0.65	2.0	2.8	2.0	2.2
25......	......	......	......	5.4	3.9	0.95	0.95	0.8	2.0	3.8	2.0	2.4
26......	......	......	......	5.2	3.6	0.95	1.0	1.35	2.0	3.9	1.9	2.4
27......	0.9	......	......	5.4	3.7	0.85	0.9	1.1	2.2	3.6	2.0	2.2
28......	......	......	......	5.8	4.0	0.8	0.25	1.0	2.2	3.4	1.8	2.0
29......	......	......	......	5.6	4.4	0.7	0.6	1.0	1.9	3.1	1.8	2.2
30......	......	......	3.1	4.7	5.7	0.0	0.8	1.1	1.6	3.0	1.9	2.4
31......	......	......	......	......	5.0	......	0.8	0.75	......	2.8	......	2.4

NOTE.— Relation of gage height to discharge affected by ice January 8th to March 12th.

Daily discharge, in second-feet, of Moose River at Moose River, N. Y., for 1912.

DAY.	Jan.	Feb.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1............	1,150	130	......	2,500	2,300	195	240	128	465	1,150	535
2............	1,020	130	......	2,210	1,760	265	215	205	535	1,590	1,020
3............	965	130	......	2,500	1,360	195	265	230	570	1,430	2,030
4............	910	130	......	2,300	1,150	90	265	315	610	1,290	1,940
5............	800	......	......	2,120	910	175	240	278	465	1,020	1,430
6............	700	......	......	1,940	750	185	265	265	465	855	1,020
7............	610	......	......	1,760	800	205	240	302	420	1,510	800
8............	595	......	......	1,760	700	228	240	290	405	2,810	610
9............	......	......	......	1,590	610	240	215	315	375	2,600	500
10............	......	......	......	1,290	610	215	215	290	405	2,030	465
11............	......	......	......	1,150	570	215	240	265	435	1,220	465
12............	......	......	......	1,150	500	195	240	252	465	1,020	535
13............	......	......	910	1,080	435	175	240	90	535	800	570
14............	......	......	1,150	1,150	345	90	228	195	610	700	610
15............	......	......	2,500	1,080	252	175	265	278	610	1,020	700
16............	......	310	6,220	1,080	90	205	240	405	610	1,020	800
17............	......	......	7,060	1,510	302	215	215	535	570	800	800
18............	......	......	5,860	1,760	315	240	265	465	535	610	700
19............	......	......	4,900	1,760	390	240	240	465	535	610	570
20............	400	......	3,580	2,030	375	240	205	420	570	610	535
21............	......	......	3,360	2,500	360	228	175	390	535	610	535
22............	......	......	3,700	2,920	278	278	90	420	610	610	700
23............	......	......	7,660	2,700	302	265	195	535	610	610	800
24............	......	......	4,540	2,300	290	265	205	610	1,020	610	700
25............	......	......	3,360	1,850	278	278	240	610	1,760	610	800
26............	......	......	3,140	1,590	278	290	390	610	1,850	570	800
27............	130	......	3,360	1,670	252	265	315	700	1,590	610	700
28............	......	......	3,820	1,940	240	128	290	700	1,430	535	610
29............	......	......	3,580	2,300	215	195	290	570	1,220	535	700
30............	......	......	2,600	3,700	90	240	315	465	1,150	570	800
31............	......	......	......	2,920	......	240	228	......	1,020	......	800

NOTE.— Daily discharge January 1st to 7th, and April 13th to December 31st determined from a well-defined rating curve.

Monthly discharge of Moose River at Moose River, N. Y., for 1912.
[Drainage area, 370 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	1,150	130	482	1.30	1.50	D
February	440	115	268	.724	.78	D
March	640	440	535	1.45	1.67	D
April	7,660	680	2,700	7.30	8.14	C
May	3,700	1,080	1,940	5.24	6.04	B
June	2,300	90	570	1.54	1.72	B
July	290	90	215	.581	.67	B
August	390	90	242	.654	.75	B
September	700	90	390	1.05	1.17	B
October	1,850	375	741	2.00	2.31	B
November	2,810	535	1,020	2.76	3.08	B
December	2,030	465	793	2.14	2.47	B
The year	7,660	90	824	2.23	30.30	

NOTE.— Discharge, January 8 to March 12, estimated by means of an ice rating curve, observers notes and climatologic records.

Middle Branch of Moose River, at Old Forge, N. Y.

Location.— About 300 feet below the highway bridge in Old Forge and about 400 feet below the dam.

Records available.— November 9, 1911, to December 31, 1912. Data also in annual reports of the United States Geological Survey.

Drainage area.— 51.5 square miles. (From U. S. G. S. topographic sheets.)

Gage.— Vertical staff, graduated to feet and tenths, reading from one foot to seven feet, spiked to birch tree on left bank of stream 300 feet below highway bridge.

Channel.— Fairly straight from dam to a point about 200 feet below the gage where the river turns abruptly to the right and flows over a rock reef which is the control point for the gage. Channel fairly uniform from dam to point of control. Right bank high and wooded, left bank from the highway bridge to within about fifty feet of the gage, defined by a stone wall about three feet above ordinary low water.

Winter flow.— Open water conditions prevail throughout the year, because of the State fish hatchery just above the station.

Accuracy.— Discharge rating curve fairly well developed. Estimates good.

Discharge measurements of Middle Branch of Moose River at Old Forge, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 26	G. H. Canfield	1.20	17.4
April 19 *b*	C. S. DeGolyer	3.61	142
19 *b*	do	3.96	342

b Back water effect at gage from north branch Moose river.

Daily gage height, in feet, of Middle Branch of Moose River, at Old Forge, N. Y., for 1912.
[Vernon S. Ervin, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.75	1.2	2.32	1.0	3.4	3.6	1.42	2.0	2.1	2.1	2.45	2.4
2.....	2.75	1.9	2.32	1.0	3.0	2.75	1.75	2.0	2.1	2.1	2.45	2.4
3.....	2.75	2.6	2.32	1.0	2.7	2.65	1.75	2.0	2.1	2.1	2.45	2.4
4.....	2.75	2.6	2.32	1.0	2.0	2.0	1.75	2.0	2.1	2.1	2.45	2.4
5.....	2.70	2.6	2.3	1.0	1.85	1.8	1.75	2.0	2.1	2.1	2.45	2.4
6.....	2.70	1.9	2.3	1.0	2.3	1.8	1.75	2.0	2.1	2.1	2.45	2.4
7.....	2.70	1.2	2.3	1.0	2.7	1.8	1.75	2.0	2.1	2.1	2.45	2.4
8.....	1.85	1.2	2.3	1.0	2.7	1.8	1.75	2.0	2.1	2.1	2.45	2.4
9.....	1.0	1.65	2.3	1.0	2.3	1.8	1.75	2.0	2.1	2.1	2.45	2.4
10.....	1.0	2.1	2.29	1.0	2.0	1.8	1.75	2.0	2.1	2.1	2.45	2.4
11.....	1.0	2.1	2.28	1.02	2.2	1.8	1.75	2.0	2.1	2.1	2.45	2.4
12.....	1.68	2.1	2.28	1.15	2.45	1.8	1.75	2.0	2.1	2.1	2.45	2.4
13.....	2.35	2.1	2.28	1.21	2.7	1.45	1.75	1.96	2.1	2.1	2.45	2.4
14.....	2.35	2.25	2.28	1.44	2.45	1.1	1.75	1.92	2.1	2.1	2.45	2.4
15.....	2.35	2.4	2.28	1.74	2.2	1.1	1.75	1.46	2.1	2.1	2.45	2.4
16.....	2.35	2.4	2.28	2.55	2.45	1.1	1.75	1.0	2.1	2.1	2.45	2.4
17.....	2.35	2.4	2.28	4.1	2.7	1.45	1.75	1.0	2.1	2.1	2.45	2.4
18.....	2.35	2.4	2.25	4.4	2.7	1.8	1.75	1.0	2.1	2.1	2.45	2.4
19.....	2.35	2.4	2.25	4.1	2.7	1.8	1.75	1.0	2.1	2.1	2.45	2.4
20.....	2.35	2.35	1.68	4.0	2.8	1.8	1.75	1.0	2.1	2.1	2.45	2.4
21.....	2.35	2.35	1.0	3.6	3.2	1.8	1.75	1.0	2.1	2.1	2.4	2.4
22.....	1.68	2.35	1.0	3.8	3.7	1.45	1.88	1.0	2.1	2.1	2.4	2.4
23.....	1.0	2.35	1.0	4.4	3.8	1.1	2.0	1.92	2.1	2.1	2.4	2.4
24.....	1.05	2.34	1.0	4.8	3.8	1.1	2.0	1.92	2.1	2.3	2.4	2.4
25.....	1.1	2.32	1.0	4.6	3.4	1.1	2.0	1.92	2.1	2.45	2.4	2.4
26.....	1.2	2.32	1.0	4.4	3.0	1.1	2.0	2.01	2.1	2.45	2.4	2.4
27.....	1.2	2.32	1.0	4.2	2.05	1.1	2.0	2.1	2.1	2.45	2.4	2.4
28.....	1.2	2.32	1.0	4.1	1.10	1.1	2.0	2.1	2.1	2.45	2.4	2.4
29.....	1.2	2.32	1.0	4.0	2.5	1.1	2.0	2.1	2.1	2.45	2.4	2.4
30.....	1.2	......	1.0	3.8	3.9	1.1	2.0	2.1	2.1	2.45	2.4	2.4
31.....	1.2	......	1.0	......	3.9	......	2.0	2.1	......	2.45	......	2.4

NOTE.— There was no ice effect during 1912. High water in the North Branch caused backwater at the gage April 17 to 19.

Daily discharge, in second-feet, of Middle Branch of Moose River at Old Forge, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	204	17	130	10	328	368	28	84	98	98	152	143
2.....	204	72	130	10	251	204	56	84	98	98	152	143
3.....	204	177	130	10	195	186	56	84	98	98	152	143
4.....	204	177	130	10	84	84	56	84	98	98	152	143
5.....	195	177	127	10	66	61	56	84	98	98	152	143
6.....	195	72	127	10	127	61	56	84	98	98	152	143
7.....	195	17	127	10	195	61	56	84	98	98	152	143
8.....	66	17	127	10	195	61	56	84	98	98	152	143
9.....	10	46	127	10	127	61	56	84	98	98	152	143
10.....	10	98	126	10	84	61	56	84	98	98	152	143
11.....	10	98	124	11	112	61	56	84	98	98	152	143
12.....	49	98	124	15	152	61	56	84	98	98	152	143
13.....	135	98	124	18	195	30	56	79	98	98	152	143
14.....	135	220	124	30	152	13	56	74	98	98	152	143
15.....	135	143	124	55	112	13	56	31	98	98	152	143
16.....	135	143	124	168	152	13	56	10	98	98	152	143
17.....	135	143	124	342	195	30	56	10	98	98	152	143
18.....	135	143	220	500	195	61	56	10	98	98	152	143
19.....	135	143	220	342	195	61	56	10	98	98	152	143
20.....	135	135	49	451	213	61	56	10	98	98	152	143
21.....	135	135	10	368	289	61	56	10	98	98	143	143
22.....	49	135	10	409	388	30	70	10	98	98	143	143
23.....	10	135	10	538	409	13	84	74	98	98	143	143
24.....	10	133	10	626	409	13	84	74	98	127	143	143
25.....	13	130	10	582	328	13	84	74	98	152	143	143
26.....	17	130	10	538	251	13	84	85	98	152	143	143
27.....	17	130	10	494	91	13	84	98	98	152	143	143
28.....	17	130	10	472	13	13	84	98	98	152	143	143
29.....	17	130	10	451	160	13	84	98	98	152	143	143
20.....	17	......	10	409	430	13	84	98	98	152	143	143
31.....	17	......	10	......	430	......	84	98	......	152	......	143

NOTE.— Daily discharge determined from a rating curve fairly well defined below 250 second-feet. April 17 to 19, estimated on basis of one discharge measurement and computed flow over dam, because of backwater.

Monthly discharge of Middle Branch of Moose River, at Old Forge, N. Y., for 1912.
[Drainage area, 51.5 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	204	10	95.1	1.85	2.13	A
February	220	17	118	2.29	2.47	A
March	220	10	88.6	1.72	1.98	A
April	626	10	231	4.49	5.01	B
May	430	13	210	4.08	4.70	B
June	368	13	60.2	1.17	1.30	B
July	84	28	63.7	1.24	1.43	A
August	98	10	66.4	1.29	1.49	A
September	98	98	98	1.90	2.12	A
October	152	98	111	2.15	2.49	A
November	152	143	149	2.90	3.24	A
December	143	143	143	2.78	3.20	A
The year	626	10	119	2.31	31.56	

ST. LAWRENCE RIVER DRAINAGE BASIN.

General Features.

St. Lawrence river, the outlet of the Great Lakes system, receives also the flow of a number of New York streams having their sources in the northerly slopes of the Adirondacks and fed by the innumerable lakes with which the region is dotted. Some of these rivers, as the Grass, Raquette, and St. Regis, lie entirely within the United States; others, notably Salmon, Trout, Chateaugay, and English rivers, cross the international boundary and flow northward into the St. Lawrence in Canada, as does also Richelieu river, the outlet of Lake Champlain. The following tables gives a list of the principal tributaries of the St. Lawrence in the United States, with the areas drained by them:

Drainage areas of St. Lawrence River tributaries in the United States.

	Square miles.		Square miles.
Oswegatchie River	1,609	Salmon River *a*	273
Grass River	637	Trout River *b*	129
Raquette River	1,219	Chateaugay River *b*	199
St. Regis River	910	English River *b*	53
Little Salmon River *a*	103	Lake Champlain *b*	8,187

a Above junction near international boundary.
b Above New York state line.

The St. Lawrence drains, through Lake Champlain, an area of about 4,560 square miles in the State of Vermont. This drainage is practically all from Missisquoi, Lamoille, and Winooski rivers and Otter creek. Clyde, Barton, and Black rivers, in northern Vermont, are tributary to St. Lawrence river through Lake Memphremagog and St. Francis river.

OSWEGATCHIE RIVER DRAINAGE BASIN.

The Oswegatchie River rises in Cranberry Lake and the mountains to the southwest in St. Lawrence and Jefferson counties, from thence it flows in a general northly direction into the St. Lawrence river at Ogdensburg, where its drainage area is 1609 square miles. The river is formed by the junction of the east branch of Oswegatchie river and the south branch of the Oswegatchie river at Dodgeville and its main tributary below this point is Indian river which flows through Black Lake. There is a considerable amount of developed water power along all three of these main tributaries and a large proportion of the power possibilities in the lower reaches of the river have also been developed.

On the east branch of Oswegatchie river there are two important possibilities for storage, one at Cranberry Lake and the other at Newton Falls.

A detailed report of the power possibilities in this drainage may be found in the Fifth Annual Report of the New York State Water Supply Commission.

Oswegatchie River near Ogdensburg, N. Y.

Location.— At the steel highway bridge known locally as Eel Weir bridge, about one mile below the mouth of the outlet of Black lake and 5½ miles above the city of Ogdensburg and the mouth of the river.

Records available.— April 22, 1903, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 1,580 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Chain, fastened to the upstream side of the bridge; read once daily; datum unchanged.

Channel.— Rocky and partly artificial, the rock having been removed underneath the bridge by blasting to increase the bridge opening.

Discharge measurements.— Usually made from the bridge. None made during 1912.

Artificial control.— Three dams in the vicinity of the gage; one at Heuvelton, about five miles above; one at Rensselaer Falls, ten miles above, and one at Ogdensburg.

Winter flow.— Not affected by ice, as velocity of the current at the station is swift.

Accuracy.— Rating curve fairly well developed; open-water curve used throughout the year.

Co-operation.— Established by the United States Geological Survey in cooperation with the State Engineer and Surveyor of New York.

Daily gage height, in feet, of Oswegatchie River near Ogdensburg, N. Y., for 1912.

[Joseph H. La Rue, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	6.4	4.9	4.9	7.2	6.5	8.1	5.0	4.6	4.8	5.4	6.0	6.1
2......	6.2	4.8	4.9	7.5	6.4	8.4	5.0	4.6	4.8	5.5	5.9	6.1
3......	6.0	4.8	4.9	7.6	6.3	8.7	5.0	4.6	4.85	5.4	5.8	6.2
4......	5.9	4.8	4.8	7.7	6.2	8.6	5.0	4.6	4.9	5.4	5.8	7.2
5......	5.8	4.8	4.8	7.8	6.0	8.4	4.9	4.6	4.9	5.4	5.8	7.6
6......	5.7	4.8	4.8	8.2	5.85	8.4	4.8	4.6	4.9	5.45	5.7	7.9
7......	5.7	4.8	4.8	8.7	5.8	8.0	4.8	4.6	4.9	5.4	5.7	7.7
8......	5.6	4.8	4.8	9.6	5.8	7.6	4.8	4.6	5.0	5.3	5.9	7.6
9......	5.6	4.8	4.8	9.8	5.75	7.2	4.8	4.7	5.0	5.3	6.2	7.6
10......	5.5	4.8	4.7	9.9	5.65	7.0	4.7	4.7	5.0	5.3	6.6	7.6
11......	5.5	4.8	4.7	9.8	5.6	6.8	4.7	4.7	5.0	5.3	6.8	7.4
12......	5.5	4.8	4.7	9.6	5.4	6.7	4.7	4.7	5.0	5.2	6.9	7.1
13......	5.4	4.7	4.7	9.2	5.5	6.6	4.6	4.7	5.0	5.2	6.9	7.0
14......	5.3	4.7	4.7	9.0	5.55	6.2	4.6	4.65	5.0	5.2	7.1	6.9
15......	5.3	4.7	4.7	8.8	5.4	6.1	4.6	4.6	4.9	5.2	7.2	6.8
16......	5.2	4.7	4.8	8.4	5.3	6.0	4.5	4.6	4.9	5.2	7.2	6.7
17......	5.1	4.7	4.8	8.2	5.3	6.0	4.5	4.6	4.9	5.2	7.3	6.6
18......	5.0	4.7	4.9	8.2	5.55	5.9	4.5	4.6	4.9	5.2	7.3	6.5
19......	5.0	4.7	4.9	8.2	5.75	5.85	4.6	4.6	4.9	5.2	7.2	6.5
20......	5.0	4.7	5.2	8.1	5.95	5.65	4.5	4.6	4.9	5.2	7.1	6.5
21......	5.0	4.7	5.9	8.0	6.4	5.5	4.6	4.6	5.05	5.2	6.8	6.5
22......	4.9	4.7	6.4	8.0	6.4	5.5	4.5	4.6	5.2	5.2	6.7	6.6
23......	4.9	4.7	6.3	7.8	6.8	5.4	4.5	4.6	5.3	5.2	6.6	6.4
24......	4.9	4.8	6.3	7.6	6.9	5.3	4.5	4.6	5.3	5.2	6.6	6.3
25......	4.9	4.8	6.2	7.6	7.0	5.2	4.5	4.6	5.4	5.3	6.6	6.2
26......	4.9	4.9	6.2	7.5	7.2	5.2	4.5	4.6	5.4	5.5	6.4	6.2
27......	4.9	4.9	6.2	7.4	7.1	5.1	4.55	4.6	5.4	5.8	6.4	6.2
28......	4.9	4.9	6.2	7.2	7.0	5.05	4.6	4.6	5.45	5.85	6.2	6.1
29......	4.9	4.9	6.2	7.0	7.0	5.0	4.6	4.6	5.4	5.95	6.2	6.1
30......	4.9	......	6.4	6.7	7.0	5.0	4.6	4.65	5.4	6.2	6.1	6.1
31......	4.9	......	6.7	......	7.6	......	4.6	4.7	......	6.0	......	6.2

NOTE.— Relation of gage height to discharge at this station probably not affected by ice.

Daily discharge, in second-feet, of Oswegatchie River near Ogdensburg, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	4,600	1,030	1,030	6,960	4,890	9,660	1,200	580	870	1,970	3,440	3,730
2......	4,020	870	1,030	7,850	4,600	10,600	1,200	580	870	2,180	3,160	3,730
3......	3,440	870	1,030	8,150	4,310	11,500	1,200	580	950	1,970	2,890	4,020
4......	3,160	870	870	8,450	4,020	11,200	1,200	580	1,030	1,970	2,890	6,960
5......	2,890	870	870	8,750	3,440	10,600	1,030	580	1,030	1,970	2,890	8,150
6......	2,640	870	870	9,960	3,020	10,600	870	580	1,030	2,080	2,640	9,050
7......	2,640	870	870	11,500	2,890	9,350	870	580	1,030	1,970	2,640	8,450
8......	2,400	870	870	14,300	2,890	8,150	870	580	1,200	1,770	3,160	8,150
9......	2,400	870	870	14,900	2,760	6,960	870	720	1,200	1,770	4,020	8,150
10......	2,180	870	720	15,200	2,520	6,360	720	720	1,200	1,770	5,180	8,150
11......	2,180	870	720	14,900	2,400	5,780	720	720	1,200	1,770	5,780	7,550
12......	2,180	870	720	14,300	1,970	5,480	720	720	1,200	1,570	6,070	6,660
13......	1,970	720	720	13,000	2,180	5,180	580	720	1,200	1,570	6,070	6,360
14......	1,770	720	720	12,400	2,290	4,020	580	650	1,200	1,570	6,660	6,070
15......	1,770	720	720	11,800	1,970	3,730	580	580	1,030	1,570	6,960	5,780
16......	1,570	720	870	10,600	1,770	3,440	450	580	1,030	1,570	6,960	5,480
17......	1,380	720	870	9,960	1,770	3,440	450	580	1,030	1,570	7,250	5,180
18......	1,200	720	1,030	9,960	2,290	3,160	450	580	1,030	1,570	7,250	4,890
19......	1,200	720	1,030	9,960	2,760	3,020	580	580	1,030	1,570	6,960	4,890
20......	1,200	720	1,570	9,660	3,300	2,520	450	580	1,030	1,570	6,660	4,890
21......	1,200	720	3,160	9,350	4,600	2,180	580	580	1,290	1,570	5,780	4,890
22......	1,030	720	4,600	9,350	4,600	2,180	450	580	1,570	1,570	5,480	5,180
23......	1,030	720	4,310	8,750	5,780	1,970	450	580	1,770	1,570	5,180	4,600
24......	1,030	870	4,310	8,150	6,070	1,770	450	580	1,770	1,570	5,180	4,310
25......	1,030	870	4,020	8,150	6,360	1,570	450	580	1,970	1,770	5,180	4,020
26......	1,030	1,030	4,020	7,850	6,960	1,570	450	580	1,970	2,180	4,600	4,020
27......	1,030	1,030	4,020	7,550	6,660	1,380	515	580	1,970	2,890	4,600	4,020
28......	1,030	1,030	4,020	6,960	6,360	1,290	580	580	2,080	3,020	4,020	3,730
29......	1,030	1,030	4,020	6,360	6,360	1,200	580	580	1,970	3,300	4,020	3,730
30......	1,030	......	4,600	5,480	6,360	1,200	580	650	1,970	4,020	3,730	3,730
31......	1,030	......	5,480	......	8,150	......	580	720	......	3,440	......	4,020

NOTE.— Daily discharge determined from a fairly well-defined rating curve.

Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for 1912.
[Drainage area, 1,580 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	4,600	1,030	1,880	1.19	1.37	B
February	1,030	720	841	.532	.57	C
March	5,480	720	2,080	1.32	1.52	B
April	15,200	5,480	10,000	6.33	7.06	A
May	8,150	1,770	4,070	2.58	2.97	A
June	11,500	1,200	5,040	3.19	3.56	A
July	1,200	450	686	.434	.50	C
August	720	580	612	.387	.45	C
September	2,080	870	1,320	.835	.93	C
October	4,020	1,570	2,010	1.27	1.46	B
November	7,250	2,640	4,910	3.11	3.47	A
December	9,050	3,730	5,570	3.53	4.07	A
The year	15,200	450	3,240	2.05	27.93	

East Branch, Oswegatchie River at Newton Falls, N. Y.

Location.— 600 feet below the lower dam of the Newton Falls Paper Company in the village of Newton Falls. It is 4 miles above the mouth of Little river (coming in from the left) and 10 miles below the outlet of Cranberry lake.

Records available.— October 6 to December 31, 1912.

Drainage area.— 194 square miles, of which 12 square miles is lake surface. (From Post Route Map and Bein's Atlas.)

Gage.— A vertical staff gage read twice daily. Gage consists of 4 feet of bronze plate gage and 2 feet marked on the face of the timber to which the gage is fastened. This timber is a 10" x 10" hemlock set vertically in a concrete pier with anchor bolts.

Channel.— One channel at all stages. Bottom consists of small boulders and gravel, covered with waste from the pulp mill above.

Discharge measurements.— At low stages measurements are made by wading 100 yards above the gage. During high water measurements are made from a cable 30 feet above the gage.

Winter flow.— No information. Ice effect is probably diminished by the disturbance of the water at the paper mill.

Artificial control.— The dams of the paper mill cause some daily fluctuation, probably not enough to affect the accuracy of the records. Seasonal flow is largely controlled by a dam at Cranberry Lake and the range of gage heights will probably not be more than 5 feet.

Accuracy.— A well defined discharge curve has been developed for ordinary stages. No high water measurements have yet been made. Estimates good.

Co-operation.— Established and maintained by the United States Geological Survey in co-operation with the New York Conservation Commission and the Newton Falls Paper Company.

Discharge measurements of East Branch, Oswegatchie River at Newton Falls, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 6 a	C. S. De Golyer	0.30	41.4
9	do	1.95	276.
Dec. 16	Frank Weber	2.95	558.
16	R. S. Barnes	2.57	454.

a Made by wading 400 feet above gage.

Daily gage height, in feet, of East Branch, Oswegatchie River at Newton Falls, N. Y., for 1912.
[Chas. H. Corp, observer.]

DAY.	Oct.	Nov.	Dec.	DAY.	Oct.	Nov.	Dec.
1	......	1.8	0.58	17	1.7	1.6	2.4
2	......	2.1	2.25	18	1.65	2.6	2.4
3	......	0.6	2.8	19	1.65	2.4	2.6
4	......	2.35	2.8	20	0.52	2.2	2.5
5	......	2.2	2.6	21	2.25	2.1	2.4
6	0.3	2.0	2.8	22	2.2	2.3	1.7
7	2.1	2.0	2.6	23	2.1	2.4	2.7
8	2.2	1.9	2.0	24	1.85	0.52	2.4
9	1.8	2.1	2.6	25	1.65	2.4	2.4
10	1.75	2.35	2.6	26	1.7	2.4	2.4
11	2.0	2.6	2.6	27	0.55	2.15	2.3
12	1.8	2.45	2.6	28	2.3	2.1	2.25
13	0.4	2.5	2.6	29	2.1	2.1	1.4
14	2.25	2.6	2.5	30	2.05	2.1	2.7
15	2.1	2.5	1.5	31	1.8	......	2.4
16	1.9	2.35	2.7				

NOTE.— Mean daily gage height obtained by weighing individual observations according to the number of hours for which each one applies, on the basis of observer's notes as to operation of mill and sluice gates.

Daily discharge, in second-feet, of East Branch, Oswegatchie River, at Newton Falls, N. Y., for 1912.

DAY.	Oct.	Nov.	Dec.	DAY.	Oct.	Nov.	Dec.
1	......	244	63	17	222	202	394
2	......	314	353	18	212	452	394
3	......	65	512	19	212	394	452
4	......	380	512	20	59	340	422
5	......	340	452	21	353	314	394
6	42	290	512	22	340	366	222
7	314	290	452	23	314	394	482
8	340	266	290	24	255	59	394
9	244	314	452	25	212	394	394
10	233	380	452	26	222	394	394
11	290	452	452	27	61	327	366
12	244	408	452	28	366	314	353
13	49	422	452	29	314	314	165
14	353	452	422	30	302	314	482
15	314	422	183	31	244	......	394
16	266	380	482				

NOTE.— Daily discharge determined from a well defined rating curve.

Monthly discharge of East Branch, Oswegatchie River at Newton Falls, N. Y., for 1912.
[Drainage area, 194 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
October 6–31	366	42	245	1.26	1.22	A
November	452	59	333	1.72	1.92	A
December	512	63	393	2.03	2.34	A

RAQUETTE RIVER DRAINAGE BASIN.

Description.

Raquette river rises in northern Hamilton county, flows practically north through a long narrow valley to St. Lawrence river. It has a total length of 162 miles, from its source to its confluence with the St. Lawrence, near the most northern point of the State.

Its source is on an elevated plateau of some 1,600 feet above sea level. The upper watershed includes many acres of swamp land, as well as a large area of lakes and ponds, including Tupper lake, Little Tupper lake, Long lake, Round lake, Blue Mountain lake, Forked lake and Raquette lake.

The high region has a heavy rainfall, the mean annual amounting to about forty-eight inches, or about ten inches above the mean for the State.

In its course through the mountains the river exhibits many falls and rapids, inviting power development under private enterprise. As yet, however, only 400 feet of the 1,400 feet of fall in the river, below Tupper lake, has been developed. The river has tremendous fluctuations between the maximum and minimum flow and is in great need of artificial regulation if the best possibilities of power development are to be realized. The State of New York Conservation Commission has under consideration extensive storage developments on this stream which, when completed, will materially benefit the existing powers and tend to make the undeveloped portions of greater economic importance.

Raquette River at Raquette Falls, near Coreys, N. Y.

Location.— Six miles above Axton, five miles below the outlet of Long lake and two miles below the mouth of Moose creek. Axton is 2½ miles south of Coreys.

Records available.— August 27, 1908, to November 10, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 418 square miles. (From U. S. G. S. topographic sheets.)

Gage.— A staff fastened to the right bank in a comparatively smooth section between two small falls; read once daily during the open water period and weekly during the ice period; datum unchanged since station was established.

Channel.— Rough, composed of large boulders; permanent; one channel at all stages.

Discharge measurements.— Made from car and cable about ten feet above the gage.

Winter flow.— Relation of gage height to discharge somewhat affected by ice.

Accuracy.— Open water discharge curve well defined. Log jams liable to occur.

Discharge measurements of Raquette River at Raquette Falls, near Corey's, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 19 *a*	F. Weber	2.04	251
April 16	do	5.25	2,560
17	do	5.75	3,400
25	do	6.55	4,260
May 18 *b*	do	4.87	1,850
19 *b*	do	4.68	1,680
July 18	G. H. Canfield	1.42	124
18	do	1.42	130
18 *c*	do	1.41	125
Sept. 12	F. Weber	2.11	280
12	do	2.11	296

a Measurement made under complete ice cover.
b Log jam below gage.
c Made by wading 2 miles below gage.

Daily gage height, in feet, of Raquette River at Raquette Falls, near Corey's, N. Y., for 1912.
[C. A. De Lancett, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3.7	......	2.2	2.4	5.7	5.1	1.8	1.4	1.6	2.7	3.4
2	3.6	......	......	2.5	5.6	5.1	1.8	1.38	2.0	2.8	3.4
3	3.5	......	......	2.5	5.4	4.9	1.7	1.5	2.1	2.75	3.4
4	3.5	......	......	2.7	5.2	4.7	1.7	1.7	2.3	2.7	3.4
5	3.4	2.4	......	2.8	5.0	4.6	1.8	1.7	2.2	2.65	3.5
6	3.2	......	......	3.0	4.9	4.5	1.9	1.6	2.5	2.6	3.5
7	......	......	......	3.5	4.9	4.4	1.8	1.6	2.5	2.6	3.5
8	3.1	......	1.4	3.9	4.9	4.2	1.7	1.55	2.35	2.55	4.1
9	......	......	......	4.4	4.9	4.1	1.6	1.6	2.2	2.5	4.0
10	......	......	......	4.6	4.9	4.0	1.5	1.6	2.1	2.45	3.9
11	......	......	......	4.6	5.0	3.9	1.6	1.6	2.1	2.4	......
12	......	......	......	4.5	5.0	3.8	1.5	2.1	2.0	2.45	......
13	......	......	......	4.5	5.1	3.7	1.4	2.0	2.0	2.45	......
14	......	......	......	4.5	4.9	3.6	1.6	1.9	1.9	2.4	......
15	2.9	......	1.8	4.6	4.8	3.5	1.5	1.8	1.9	2.4	......
16	......	......	......	5.1	4.6	3.4	1.7	1.7	2.5	2.4	......
17	......	......	......	5.8	4.6	3.3	1.55	1.6	2.4	2.45	......
18	......	2.2	......	6.0	4.7	3.1	1.42	1.6	2.4	2.5	......
19	......	2.04	......	6.3	4.7	3.0	1.42	1.6	2.4	2.9	......
20	......	......	......	6.3	4.7	2.9	1.38	1.55	2.4	2.8	......
21	......	......	......	6.2	5.2	2.8	1.38	1.5	2.45	2.8	......
22	3.6	......	2.3	6.1	5.7	2.7	2.0	1.5	2.5	2.85	......
23	......	1.8	......	6.3	5.7	2.6	1.85	1.5	2.55	2.9	......
24	......	......	......	6.7	5.6	2.5	1.70	1.6	2.6	2.9	......
25	......	......	......	6.7	5.6	2.4	1.6	1.7	2.6	3.2	......
26	......	......	......	6.5	5.3	2.3	1.55	1.8	2.6	3.2	......
27	......	......	......	6.5	5.3	2.2	1.5	2.15	2.6	3.3	......
28	3.3	......	......	6.0	5.1	2.1	1.42	2.1	2.65	3.3	......
29	......	......	2.4	6.0	4.9	2.0	1.5	2.0	2.6	3.3	......
30	......	......	......	5.8	5.2	1.9	1.45	1.9	2.6	3.35	......
31	......	......	......	......	5.1	......	1.41	1.7	......	3.35	......

NOTE.— Relation of gage height to discharge affected by ice January 7 to March 18. On account of the relatively high velocities at this station, the ice effect was not great.
A log jam caused backwater at the gage May 6 to 25.

RAQUETTE RIVER AT PIERCEFIELD, N. Y. Fig. L.
Automatic gage.

Daily discharge, in second-feet, of Raquette River at Raquette Falls, near Corey's, N. Y., for 1912

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1,200	530	295	372	3,240	2,440	202	123	159	484	854
2	1,120	490	270	407	3,100	2,440	202	120	252	528	854
3	1,040	450	245	407	2,820	2,200	180	140	280	506	854
4	1,040	400	220	484	2,560	1,960	180	180	339	484	854
5	970	355	195	528	2,320	1,850	202	180	309	464	920
6	830	350	170	626	1,880	1,750	226	159	407	444	920
7	800	345	145	920	1,880	1,650	202	159	407	444	920
8	770	340	115	1,220	1,880	1,470	180	150	356	426	1,380
9	740	335	125	1,650	1,880	1,380	159	159	309	407	1,300
10	700	330	140	1,850	1,880	1,300	140	159	280	390	1,220
11	670	325	150	1,850	2,000	1,220	159	159	280	372	......
12	630	320	160	1,750	2,000	1,140	140	280	252	390	......
13	600	315	170	1,750	2,100	1,060	123	252	252	390	......
14	560	310	180	1,750	1,880	990	159	226	226	372	......
15	530	305	190	1,850	1,780	920	140	202	226	372	......
16	570	300	210	2,440	1,600	854	180	180	407	372	......
17	610	295	230	3,380	1,600	792	150	159	372	390	......
18	650	295	250	3,660	1,690	678	126	159	372	407	......
19	690	251	270	4,100	1,690	626	126	159	372	576	......
20	740	235	290	4,100	1,690	576	120	150	372	528	......
21	780	220	315	3,940	2,200	528	120	140	390	528	......
22	820	205	339	3,800	2,800	484	252	140	407	552	......
23	800	190	343	4,100	2,800	444	214	140	426	576	......
24	780	205	348	4,740	2,670	407	180	159	444	576	......
25	760	220	352	4,740	2,670	372	159	180	444	734	......
26	740	235	357	4,420	2,680	339	150	202	444	734	......
27	720	250	362	4,420	2,680	309	140	294	444	792	......
28	690	265	367	3,660	2,440	280	126	280	464	792	......
29	650	280	372	3,660	2,200	252	140	252	444	792	......
30	610	......	372	3,380	2,560	226	132	226	444	823	......
31	570	......	372	......	2,440	......	125	180	......	823	......

NOTE.— Daily discharge January 1 to 6, determined from a well defined rating curve.

Daily discharge March 19 to May 5 and May 26 to December 31, determined from a fairly well defined rating curve.

Daily discharge May 6 to 25, determined from a rating curve based on two measurements made while the log jam existed.

Daily discharge during the period of ice effect, January 7 to March 18, estimated by means of a rating curve based on one measurement made with ice present, and the shape of the open water rating curve.

Daily discharge interpolated for days when gage was not read.

Monthly discharge of Raquette River at Raquette Falls, near Corey's, N. Y., for 1912.

[Drainage area, 418 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	1,200	530	754	1.80	2.08	C
February	530	190	308	.737	.79	C
March	372	115	255	.610	.70	C
April	4,740	372	2,530	6.05	6.75	B
May	3,240	1,600	2,250	5.38	6.20	B
June	2,440	226	1,030	2.46	2.74	A
July	252	120	162	.388	.45	A
August	294	120	182	.435	.50	A
September	464	159	353	.844	.94	A
October	823	372	531	1.27	1.46	A
November 1-10	1,380	854	1,010	2.42	.90	A

Raquette River at Piercefield, N. Y.

Location.— About three-fourths mile above the head of Black Rapids and one-half mile below the dam of the International Paper Company at Piercefield.

Records available.— August 20, 1908, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 723 square miles. All but 16 square miles from U. S. G. S. Topographic sheets.

Gage.— August 20, 1908, to September 3, 1910, vertical staff fastened to a large pine stump.

September 4 to December 31, 1910, chain gage fastened to same stump and having the same datum.

January 1, 1911, to December 31, 1912, same chain gage with its datum 2 feet lower. See Fig. K.

During 1912 a Stevens automatic gage was installed in a galvanized sheet-iron house 4 feet by 6 feet inside dimensions. The instrument is set over a concrete well 3½ feet square inside dimensions and 15 feet deep. The well is connected with the river by a 4-inch cast-iron water pipe 60 feet long. A shear gate valve is set at the inner end of the pipe for use in cleaning the well. The outer end of the pipe terminates in a concrete box one foot square, inside dimensions. See Fig. L.

This box is connected with the river by three small intake pipes 2 inches in diameter with a screen protection over their outer ends. The river at this point contains a considerable amount of wood pulp and this special construction was deemed necessary to keep the pulp out of the intake pipe.

Channel.— The channel opposite the gage is a deep pond having no perceptible velocity. The control of this pond is at the head of Black Rapids and is permanent.

Discharge measurements.— Made from a U. S. G. S. standard car running on a cable (span 171 feet) at the section formerly used for boat measurements just above Black Rapids.

Winter flow.— The rapids controlling the stream at the gage rarely freeze and measurements made with ice present indicate that the relation between gage height and discharge is little if any affected by ice. Open water discharge rating curve usually applicable throughout the year.

Artificial control.— The dam of the International Paper Company controls the flow of the stream at the station during low water periods, but the mill is usually run for 24 hours each day, except Sundays. The numerous lakes in the upper part of the drainage basin afford considerable storage, most of which is controlled.

Accuracy.— Although the discharge at this station is somewhat affected by artificial control, the records are believed to be good. With automatic gage should be excellent.

Co-operation.— Established by the United States Geological Survey in co-operation with the State of New York Conservation Commission. The recording gage is attended by an employee of the International Paper Co.

RAQUETTE RIVER AT PIERCEFIELD, N. Y. Fig. K.
Chain gage and Automatic gage shelter.

Discharge measurements of Raquette River at Piercefield, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 31 a.....	Frank Weber....................................	5.38	1,030
Feb. 20 a.....	do	4.00	454
July 16.......	G. H. Canfield..................................	3.80	424
Oct. 23.......	Frank Weber....................................	5.50	1,110

a Made under complete ice cover 1½ miles below gage.

Daily gage height, in feet, of Raquette River at Piercefield, N. Y., for 1912.
[W. B. Graves, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1......	7.1	4.5	4.4	4.2	10.6	7.2	4.4	3.8	2.1	3.35	5.8	6.2
2.....	6.9	4.6	4.3	4.3	10.5	7.0	4.2	3.5	1.4	3.6	5.8	6.3
3.....	6.9	4.5	1.7	4.3	10.3	7.2	4.2	2.0	3.3	4.6	4.4	6.2
4.....	7.1	2.25	1.85	4.3	10.4	7.2	4.2	1.55	3.9	5.1	6.0	6.2
5.....	6.8	4.6	4.1	4.4	9.2	7.2	4.2	3.25	4.0	5.3	5.9	6.3
6.....	6.6	4.6	4.2	4.3	9.1	7.2	4.3	3.8	4.0	3.1	6.0	6.3
7.....	6.6	4.4	4.3	3.8	9.1	7.2	2.6	3.8	4.1	4.1	6.0	6.2
8.....	6.4	4.4	4.3	4.2	8.8	7.1	4.2	3.8	2.7	5.7	6.0	6.0
9.....	5.8	4.5	4.3	4.6	8.8	6.8	3.6	3.6	3.8	5.4	6.0	6.1
10.....	5.2	4.4	1.6	4.6	8.8	7.2	3.4	2.75	4.3	5.2	5.5	6.2
11.....	5.5	2.25	1.9	4.6	8.6	6.8	4.2	1.55	4.2	5.4	6.4	6.4
12.....	5.8	4.6	4.0	4.9	7.8	6.8	3.1	3.5	4.1	5.2	7.2	6.2
13.....	5.8	4.7	4.2	4.8	7.9	6.6	2.9	3.8	4.1	3.3	7.3	6.2
14.....	5.8	4.6	4.3	4.8	7.8	6.6	1.88	3.8	4.2	5.6	7.2	6.1
15.....	5.8	4.6	4.3	5.6	7.7	6.6	2.55	3.8	2.8	5.2	7.2	5.8
16.....	5.8	4.5	4.3	6.0	7.6	6.2	3.7	3.4	3.8	5.4	7.2	6.2
17.....	5.8	4.5	1.65	6.8	7.6	6.5	3.6	2.8	4.0	5.3	6.6	6.3
18.....	5.4	2.0	1.75	6.8	7.4	6.3	3.6	1.65	4.1	5.6	7.4	6.3
19.....	4.4	4.4	4.2	7.2	7.5	6.4	1.75	3.5	4.1	5.2	7.6	6.2
20.....	3.8	4.5	4.2	7.5	7.4	6.2	1.5	3.8	4.2	2.9	7.8	6.3
21.....	3.8	4.5	4.1	7.2	7.2	6.0	1.4	3.8	4.0	5.4	7.6	6.2
22.....	3.8	4.5	4.1	8.1	7.3	6.0	3.45	3.8	3.4	5.4	7.4	4.7
23.....	3.8	4.5	4.1	8.6	7.2	4.6	3.8	3.7	3.8	5.6	7.4	4.8
24.....	5.0	4.5	1.7	9.0	7.2	5.5	3.8	2.75	4.1	5.3	6.2	4.8
25.....	5.2	1.9	2.05	9.6	7.1	6.2	3.8	1.55	4.2	5.0	6.5	4.8
26.....	5.2	2.05	4.1	9.7	6.4	5.8	1.85	3.3	4.2	5.2	6.6	5.5
27.....	5.2	4.4	4.1	10.5	6.8	5.8	1.8	3.9	4.1	3.1	6.5	5.8
28.....	2.75	4.4	4.1	9.8	7.2	5.5	1.55	3.8	4.2	5.6	6.6	5.8
29.....	5.2	4.4	4.2	10.7	7.5	5.5	3.6	3.7	2.85	5.4	6.5	5.0
30.....	5.3	......	4.3	11.4	7.4	2.45	3.8	3.8	4.0	5.5	6.4	5.4
31.....	5.4	......	4.0	......	7.3	......	3.8	3.8	......	5.4	......	5.8

NOTE.— Relation of gage height to discharge at this station not affected by ice.

Daily discharge, in second-feet, of Raquette River at Piercefield for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2,290	650	615	545	6,100	2,380	615	425	96	303	1,280	1,560
2.....	2,110	690	580	580	5,980	2,200	545	342	44	369	1,280	1,630
3.....	2,110	650	64	580	5,740	2,380	545	88	290	690	615	1,560
4.....	2,290	110	76	580	5,860	2,380	545	54	455	895	1,420	1,560
5.....	2,020	690	515	615	4,430	2,380	545	278	485	990	1,350	1,630
6.....	1,860	690	545	580	4,320	2,380	580	425	485	244	1,420	1,630
7.....	1,860	615	580	425	4,320	2,380	147	425	515	515	1,420	1,560
8.....	1,700	615	580	545	3,980	2,290	545	425	161	1,220	1,420	1,420
9.....	1,280	650	580	690	3,980	2,020	369	369	425	1,040	1,420	1,490
10.....	940	615	57	690	3,980	2,380	316	169	580	940	1,100	1,560
11.....	1,100	110	80	690	3,760	2,020	545	54	545	1,040	1,700	1,700
12.....	1,280	690	485	810	2,950	2,020	244	342	515	940	2,380	1,560
13.....	1,280	730	545	770	3,050	1,860	196	425	515	290	2,470	1,560
14.....	1,280	690	580	770	2,950	1,860	78	425	545	1,100	2,380	1,490
15.....	1,280	690	580	1,160	2,850	1,860	141	425	177	940	2,380	1,280
16.....	1,280	650	580	1,420	2,750	1,560	397	316	425	1,040	2,380	1,560
17.....	1,280	650	60	2,020	2,750	1,780	369	177	485	990	1,860	1,630
18.....	1,040	88	68	2,020	2,560	1,630	369	60	515	1,160	2,560	1,630
19.....	615	615	545	2,380	2,650	1,700	68	342	515	940	2,750	1,560
20.....	425	650	545	2,650	2,560	1,560	50	425	545	196	2,950	1,630
21.....	425	650	515	2,380	2,380	1,420	44	425	485	1,040	2,750	1,560
22.....	425	650	515	3,250	2,470	1,420	329	425	316	1,040	2,560	730
23.....	425	650	515	3,760	2,380	690	425	397	425	1,160	2,560	770
24.....	850	650	64	4,200	2,380	1,100	425	169	515	990	1,560	770
25.....	940	80	92	4,900	2,290	1,560	425	54	545	850	1,780	770
26.....	940	92	515	5,020	1,700	1,280	76	290	545	940	1,860	1,100
27.....	940	615	515	5,980	2,020	1,280	72	455	515	244	1,780	1,280
28.....	169	615	515	5,140	2,380	1,100	54	425	545	1,160	1,860	1,280
29.....	940	615	545	6,220	2,650	1,100	369	397	186	1,040	1,780	850
30.....	990	......	580	7,060	2,560	130	425	425	485	1,100	1,700	1,040
31.....	1,040	......	485	......	2,470	......	425	425	......	1,040	......	1,280

NOTE.— Daily discharge determined from a well defined rating curve.

Daily gage height, in feet, and discharge, in second-feet, of Raquette River at Piercefield, N. Y., for 1912.
[From the Recording Gage.]

DAY.	OCTOBER.		NOVEMBER.		DECEMBER.		DAY.	OCTOBER.		NOVEMBER.		DECEMBER.	
	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.		Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
1....	......	....	5.67	1,200	6.16	1.530	17....	......	....	6.99	2,190	6.21	1,570
2....	......	....	5.82	1,290	6.32	1,640	18....	......	....	7.33	2,500	6.20	1,560
3....	......	....	4.73	740	6.36	1,670	19....	......	....	7.25	2,420	6.15	1,520
4....	......	....	5.87	1,330	6.40	1,700	20....	......	....	7.12	2,310	6.14	1,520
5....	......	....	5.96	1,390	6.45	1,740	21....	......	....	7.13	2,320	6.10	1,490
6....	......	....	5.89	1,340	6.46	1,750	22....	5.08	886	6.65	1,900	5.55	1,130
7....	......	....	5.92	1,360	6.78	2,000	23....	5.35	1,020	6.88	2,090	5.68	1,210
8....	......	....	5.91	1,360	6.23	1,580	24....	5.15	918	6.44	1,730	5.77	1,260
9....	......	....	6.23	1,580	6.60	1,860	25....	5.04	868	6.85	2,060	5.46	1,080
10....	......	....	6.40	1,700	6.49	1,770	26....	5.37	1,020	6.67	1,920	5.95	1,380
11....	......	....	6.96	2,160	6.47	1,760	27....	3.66	386	6.60	1,860	6.00	1,410
12....	......	....	7.01	2,210	6.44	1,730	28....	4.72	738	6.54	1,810	5.99	1,410
13....	......	....	7.03	2,230	6.42	1,720	29....	5.46	1,080	6.43	1,720	5.07	882
14....	......	....	7.09	2,280	6.15	1,520	30....	5.48	1,090	6.32	1,640	5.88	1,340
15....	......	....	7.19	2,370	6.16	1,530	31....	5.56	1,140	......	....	5.94	1,380
16....	......	....	7.18	2,360	6.30	1,630							

Monthly discharge of Raquette River at Piercefield, N. Y., for 1912.
[Drainage area, 723 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	2,290	169	1,210	1.67	1.92	A
February	730	80	557	.769	.83	B
March	615	57	423	.585	.67	B
April	7,060	425	2,280	3.15	3.51	A
May	6,100	1,700	3,330	4.61	5.32	A
June	2,380	130	1,740	2.41	2.69	A
July	615	44	332	.459	.53	A
August	455	54	319	.441	.51	A
September	580	44	429	.593	.66	B
October	1,220	244	853	1.18	1.36	A
November	2,950	615	1,890	2.61	2.91	A
December	1,700	730	1,380	1.91	2.20	A
The year	7,060	44	1,220	1.69	23.11	

Monthly discharge of Raquette River at Piercefield, N. Y., for 1912. From the Recording Gage.
[Drainage area, 723 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.
	Maximum.	Minimum.	Mean.	Per square miles.	Depth in inches on drainage area.
October, 22–31	....	....	915	1.27	.47
November	2,700	740	1,850	2.56	2.86
December	2,150	882	1,520	2.10	2.42

Raquette River at Massena Springs, N. Y. (Concrete Bridge.)

Location.— At highway bridge at Massena Springs, N. Y., 1,000 feet above the New York Central railroad bridge, used for freight transfer from the railroad station to the Massena power plant, 8 miles below Raymondville and 10 miles above the mouth of the stream.

Records available.— September 21, 1903, to October 17, 1903, April 9, 1904, to December 31, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 1,170 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Original gage was a vertical staff fastened to a stone wall on the left bank about 50 feet upstream from the present bridge. This was replaced by a standard U. S. G. S. chain gage on August 16, 1906, fastened to an old highway bridge located just above the present bridge. The datum of the chain gage was set 1.00 lower than that of the staff gage to prevent

negative gage heights. On February 2, 1912, the chain gage was reset on the present concrete bridge at such a datum that readings should be comparable with those at the former location.

Channel.— Bed of river of coarse gravel and small boulders; permanent; current good at all points.

Discharge measurements.— Formerly made from old highway bridge now made from new bridge. Gaging conditions are fair at new bridge but the rating has changed somewhat.

Artificial control.— The operation of a number of power plants above the station has marked effect on the low water discharge of the stream. These plants are usually run for 24-hour power, but are closed on Sundays. The effect of the Sunday closing is shown in the stream for several days.

Winter flow.— Ice forms at this station to a thickness of 3 feet and considerably affects the relation of gage height to discharge for December, January, February, and March.

Accuracy.— Determinations of monthly discharge considered good, but those of daily discharge may be considered in error for low water periods due to artificial control. Monthly estimates for periods during which ice is present also subject to large errors.

Co-operation.— Established by the United States Geological Survey in co-operation with the State Engineer and Surveyor of New York, maintained at present in co-operation with Conservation Commission.

Discharge measurements of Raquette River at Massena Springs, N. Y. (concrete bridge), in 1912.

DATE.	Hydrographer.	Gage height.[b]	Discharge.
		Feet.	*Sec.-ft.*
Feb. 1[a]	G. H. Canfield	4.28	696
2[a]	Frank Weber	4.72	916
24[a]	do	4.81	896
Mar. 14[a]	C. S. De Golyer	3.64	498
April 12	Frank Weber	6.66	4,810
13	do	6.64	4,610
19	do	9.29	8,610
20	do	9.01	8,270
May 15	do	5.68	4,050
July 26	G. H. Canfield	1.58	395
27[c]	do	1.63	378
Oct. 21	J. G. Mathers	2.79	1,050
24	do	2.02	620
25	do	3.41	1,530

a Measurement made under complete ice cover.
b Gage height for measurement of February 1st from old gage. For all later measurements from gage located on new concrete bridge.
c Made by wading near site of old bridge.

Daily gage height, in feet, of Raquette River at Massena Springs, N. Y. (Concrete Bridge) for 1912.
[F. L. Babcock, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	8.4	4.9	4.2	7.6	8.2	9.0	1.90	1.65	1.7	3.2	3.0	4.2
2.....	......	4.7	4.0	7.4	8.0	8.0	2.25	1.65	1.6	3.1	3.0	4.0
3.....	......	......	4.0	7.0	7.6	7.4	2.25	1.75	1.8	3.0	3.2	4.0
4.....	8.4	......	4.4	5.8	7.4	6.8	1.95	1.55	1.85	3.0	3.2	4.4
5.....	......	......	4.4	7.4	7.0	6.7	1.3	1.75	2.0	2.8	3.3	5.5
6.....	......	4.4	4.4	12.8	7.0	6.7	1.8	2.1	2.35	3.0	3.4	6.1
7.....	......	......	4.4	13.6	6.8	6.4	2.0	2.1	2.6	3.0	4.2	6.0
8.....	......	......	4.4	12.4	6.7	6.1	2.5	2.05	2.6	3.1	5.9	5.8
9.....	......	......	4.4	10.0	6.6	5.8	2.1	1.95	2.6	3.0	5.8	5.8
10.....	......	......	4.2	9.0	6.5	5.8	1.65	2.1	2.6	2.6	5.6	5.6
11.....	6.8	......	4.0	8.6	6.2	5.8	1.45	1.85	2.05	3.1	5.0	5.6
12.....	......	4.6	4.0	6.9	6.0	5.2	1.75	2.05	1.75	3.2	5.0	5.4
13.....	......	......	4.4	6.6	6.0	5.2	1.65	2.35	2.0	3.1	5.4	5.2
14.....	......	......	3.6	6.6	5.8	5.0	1.6	2.1	2.8	3.0	5.8	5.2
15.....	......	......	4.0	6.8	5.6	4.6	1.85	1.95	2.6	3.0	5.8	5.3
16.....	......	......	4.4	7.3	5.6	4.6	1.85	1.30	2.6	2.9	5.7	5.5
17.....	......	4.4	5.0	8.1	5.8	4.8	1.75	1.75	2.5	2.45	5.6	6.2
18.....	......	......	4.6	9.1	6.0	4.0	1.6	1.6	2.4	2.3	5.4	7.0
19.....	6.5	4.4	5.4	9.4	6.0	4.2	1.5	1.85	2.4	2.8	4.8	6.9
20.....	......	3.8	6.0	9.0	5.8	4.0	1.45	2.0	2.6	2.9	5.0	6.8
21.....	......	3.8	6.0	8.8	6.0	3.7	1.35	1.8	2.6	2.8	4.9	6.6
22.....	......	3.8	5.8	8.8	6.4	3.6	1.25	1.85	2.8	2.8	4.8	6.6
23.....	......	3.7	5.4	8.9	6.6	3.4	2.4	1.85	2.8	2.8	4.7	6.6
24.....	......	5.0	5.4	9.4	6.5	3.2	1.8	1.95	2.9	2.6	4.6	6.5
25.....	4.9	4.8	5.2	9.4	6.7	3.0	1.75	2.9	3.0	3.4	4.8	6.4
26.....	......	4.6	4.8	9.3	6.6	2.8	1.6	2.45	3.0	3.8	4.9	6.5
27.....	......	4.5	4.8	9.1	6.5	2.8	1.55	2.15	3.0	3.4	4.8	6.4
28.....	......	4.2	4.8	8.9	6.6	2.9	2.6	1.9	3.1	3.4	4.7	6.3
29.....	......	4.2	6.0	8.6	6.9	2.8	1.7	1.45	3.2	3.3	4.6	6.4
30.....	......	......	7.0	8.4	8.0	2.6	1.7	0.7	3.2	3.2	4.4	6.4
31.....	......	......	7.0	......	10.2	......	1.9	1.45	......	3.0	......	6.2

Relation of gage height to discharge affected by ice January 1 to April 8.

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y. (Concrete Bridge), for 1912

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	......	955	675	2,000	6,870	8,050	515	398	420	1,360	1,200	2,220
2.....	......	865	605	2,000	6,590	6,590	705	398	375	1,280	1,200	2,040
3.....	......	835	605	2,000	6,040	5,780	705	442	465	1,200	1,360	2,040
4.....	......	805	745	3,000	5,780	5,020	540	355	490	1,200	1,360	2,410
5.....	......	775	745	4,000	5,270	4,900	261	442	565	1,060	1,440	3,520
6.....	......	745	745	4,000	5,270	4,900	465	620	765	1,200	1,520	4,180
7.....	......	755	745	4,000	5,020	4,530	565	620	925	1,200	2,220	4,070
8.....	......	770	745	4,000	4,900	4,180	860	592	925	1,280	3,960	3,850
9.....	......	785	745	9,590	4,770	3,850	620	540	925	1,200	3,850	3,850
10.....	......	800	675	8,050	4,650	3,850	398	620	925	925	3,630	3,630
11.....	......	815	605	7,450	4,290	3,850	316	490	592	1,280	3,010	3,630
12.....	......	825	605	5,140	4,070	3,210	442	592	442	1,360	3,010	3,410
13.....	......	810	745	4,770	4,070	3,210	398	765	565	1,280	3,410	3,210
14.....	......	795	490	4,770	3,850	3,010	375	620	1,060	1,200	3,850	3,210
15.....	......	780	605	5,020	3,630	2,610	490	540	925	1,200	3,850	3,310
16.....	......	760	745	5,640	3,630	2,610	490	261	925	1,130	3,740	3,520
17.....	......	745	1,000	6,730	3,850	2,810	442	442	860	828	3,630	4,290
18.....	......	745	825	8,200	4,070	2,040	375	375	795	735	3,410	5,270
19.....	......	745	1,200	8,650	4,070	2,220	335	490	795	1,060	2,810	5,140
20.....	......	545	1,540	8,050	3,850	2,040	316	565	925	1,130	3,010	5,020
21.....	......	545	1,540	7,750	4,070	1,770	279	465	925	1,060	2,910	4,770
22.....	......	545	1,420	7,750	4,530	1,680	244	490	1,060	1,060	2,810	4,770
23.....	......	515	1,200	7,900	4,770	1,520	795	490	1,060	1,060	2,710	4,770
24.....	......	1,000	1,200	8,650	4,650	1,360	465	540	1,130	925	2,610	4,650
25.....	......	910	1,100	8,650	4,900	1,200	442	1,130	1,200	1,520	2,810	4,530
26.....	......	825	910	8,500	4,770	1,060	375	828	1,200	1,860	2,910	4,650
27.....	......	785	910	8,200	4,650	1,060	355	648	1,200	1,520	2,810	4,530
28.....	......	675	910	7,900	4,770	1,130	925	515	1,280	1,520	2,710	4,410
29.....	......	675	1,540	7,450	5,140	1,060	420	316	1,360	1,440	2,610	4,530
30.....	......	......	2,000	7,160	6,590	925	420	86	1,360	1,360	2,410	4,530
31.....	......	......	2,000	......	9,910	......	515	316	......	1,200	......	4,290

NOTE.— Daily discharge, April 9 to December 31, determined from a well defined rating curve. Daily discharge, February 1 to April 8, obtained by means of a well defined rating curve based on measurements made under ice cover, and comparison with the discharge at Piercefield.

Monthly discharge of Raquette River at Massena Springs, N. Y., (Concrete Bridge) for 1912.
[Drainage area, 1,170 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	a 1,500	1.28	1.48	D
February	1,000	515	763	.652	.70	C
March	a 2,000	490	972	.831	.96	C
April	9,590	a 2,000	6,230	5.32	5.94	B
May	9,910	3,630	4,940	4.22	4.86	B
June	8,050	925	3,070	2.62	2.92	B
July	925	244	479	.409	.47	B
August	1,130	86	516	.441	.51	B
September	1,360	375	881	.753	.84	B
October	1,860	735	1,210	1.03	1.19	B
November	3,960	1,200	2,760	2.36	2.63	B
December	5,270	2,040	3,940	3.37	3.88	B
The year	9,910	86	2,270	1.94	26.38	

a Estimated by means of comparison with the discharge at Piercefield.

Bog River near Tupper Lake, N. Y.

Location.— Mouth of Bog river, head of Tupper lake, 1½ miles below the junction of Bog river and the outlet of Round pond.

Records available.— August 24, 1908, to June 30, 1912. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

Drainage area.— 132 square miles. (From U. S. G. S. Water Supply Papers.)

Gage.— Staff, fastened to the left wing wall of an unused dam; read once daily; datum unchanged.

Channel.— Possibly shifting, as the bed is composed of rock on one side and gravel on the other. The crest of the dam with the brink of the adjacent falls forms a control point considered permanent.

Discharge measurements.— Made from a car and cable about 1½ miles above the gage and immediately below the mouth of the outlet of Round pond.

Artificial control.— The flow is more or less regulated during the spring for log driving. The operation of a small power plant on the main stream causes some variation in the daily gage heights during the low water periods in the summer.

Winter flow.— The gage readings are usually not observed from December to March on account of ice.

Accuracy.— Discharge curve fairly well developed. Estimates good.

Bog river and its tributary drain a number of small lakes and ponds among which are Higging, First, Second and Third ponds on the tributary, all of which lie south and southwest of Big Tupper Lake. The station is important in connection with stations on the Raquette at Raquette Falls and Piercefield in the study of storage feasible in Tupper Lake.

Discharge measurements of Bog River near Tupper Lake, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 17	Frank Weber	2.52	331
17	do	2.57	336

Daily gage height, in feet, of Bog River near Tupper Lake, N. Y., for 1912.

[B. O. Lott, observer.]

DAY.	Mar.	April.	May.	June.	DAY.	Mar.	April.	May.	June.
1		2.4	4.0	3.5	17		4.5	2.5	1.9
2		2.4	3.6	3.4	18		4.6	2.6	1.8
3		2.4	3.2	3.4	19		4.6	2.6	1.7
4		2.5	3.0	3.4	20		4.5	2.7	1.6
5		2.6	2.8	3.4	21		4.4	2.8	1.6
6		2.6	2.8	3.4	22	2.2	4.6	3.1	1.5
7		2.6	2.7	3.8	23		4.6	3.6	1.5
8		2.6	2.6	3.0	24		4.6	3.5	1.5
9		2.5	2.6	2.8	25	2.2	4.6	3.4	1.5
10		2.6	2.5	2.6	26		4.6	3.3	1.4
11		2.6	2.4	2.5	27		4.6	3.3	1.4
12		2.6	2.5	2.4	28	2.3	4.6	3.3	1.3
13		2.6	2.5	2.4	29		4.5	3.5	1.3
14		2.8	2.5	2.3	30		4.2	3.7	1.3
15		2.9	2.4	2.1	31	2.3		3.7	
16		3.5	2.4	2.0					

NOTE.— The relation of gage height to discharge was probably affected by ice from March 22 to 31.

Daily discharge, in second-feet, of Bog River near Tupper Lake, N. Y., for 1912.

DAY.	Mar.	April.	May.	June.	DAY.	Mar.	April.	May.	June.
1		285	940	700	17		1,190	315	160
2		285	745	655	18		1,240	350	140
3		285	570	655	19		1,240	350	120
4		315	490	655	20		1,190	385	105
5		350	420	655	21		1,140	420	105
6		350	420	655	22	230	1,240	530	90
7		350	385	610	23	[230]	1,240	745	90
8		350	350	490	24	[230]	1,240	700	90
9		315	350	420	25	230	1,240	655	90
10		350	315	350	26	[240]	1,240	610	75
11		350	285	315	27	[250]	1,240	610	75
12		350	315	285	28	255	1,240	610	60
13		350	315	285	29	[255]	1,190	700	60
14		420	315	255	30	[255]	1,040	790	60
15		455	285	205	31	255		790	
16		700	285	180					

NOTE.— Daily discharge determined from a fairly well-defined rating curve.

Monthly discharge of Bog River near Tupper Lake, N. Y., for 1912.

[Drainage area, 132 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
April	1,240	285	759	5.75	6.42	C
May	940	285	495	3.75	4.32	B
June	700	60	290	2.20	2.46	B

Station discontinued June 30, 1912.

St. Regis River Drainage Basin.

Description.

The St. Regis river has its source in several small streams and lakes in the western part of Franklin county at an elevation of about 1,500 feet above the sea. It first flows in a northwesterly direction for about forty miles and then somewhat east of north for about 28 miles to its mouth, in the St. Lawrence river near the State line. It has a drainage area of 664 square miles (State Water Supply Commission). The upper portion of its watershed consists of swamp and mountains from which the forest has been largely cut. Upon leaving the plateau the stream descends for 10 or 15 miles through a rugged country with a succession of steep rapids and precipitous falls to the low lands bordering the St. Lawrence.

There are excellent opportunities for developing power in the descent, only a few of which have as yet been utilized. From the foot of the hills to the St. Lawrence, the slope of the river is moderate and rock out-crop not frequent, consequently favorable sites for power development are scarce. According to report of the State Water Supply Commission for 1910, the present limit of profitable development through this low country, except as increased by regulation of stream flow has probably been reached in the existing plants. A detailed description, showing all power developments and future possible developments is given in the 1910 report of the State Water Supply Commission.

St. Regis River at Brasher Center, N. Y.

Location.— At the steel highway bridge in the village of Brasher Center, 5 miles downstream from Brasher Falls, 6¼ miles below the junction of East and West branches of St. Regis river, and about 12 miles above the mouth.

Records available.— August 22, 1910, to December 31, 1911. Data published also in annual reports of State Water Supply Commission and State Conservation Commission of New York.

Drainage area.— 621 square miles (measured on post-route map).

Gage.— Chain, fastened to downstream side of bridge; read twice daily; datum unchanged.

Channel.— Very rough; composed of gravel and large bowlders; considered permanent. Velocity of current at high stages very swift and water rough.

Discharge measurements.— At low stages made by wading about 500 feet below the bridge; at high stages made from the bridge.

Winter flow.— Relation of gage height to discharge affected by ice.

Accuracy.— Discharge rating curve well developed. Estimates good.

Discharge measurements of St. Regis River at Brasher Center, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 21 *a*	Frank Weber	5.64	442
April 11	do	6.18	3,600
14	do	5.85	2,870
18	do	6.70	5,440
May 14	do	5.09	1,410
July 25	G. H. Canfield	4.15	341
Oct. 23	J. G. Mathers	4.38	523

a Complete ice cover. Control frozen.

Daily gage height, in feet, of St. Regis River at Brasher Center, N. Y., for 1910.
[George Myers, observer.]

DAY.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	4.12	4.12	4.85	4.42
2	......	4.1	4.1	4.85	4.6
3	......	4.22	4.1	4.7	4.55
4	......	4.18	4.25	4.8	4.7
5	......	4.16	4.32	4.8	4.8
6	......	4.22	4.4	4.9	4.7
7	......	5.1	5.2	5.0	5.2
8	......	5.2	5.5	4.9	5.2
9	......	4.95	5.4	4.8	5.85
10	......	4.7	5.2	4.8	6.0
11	......	4.55	4.95	5.05	6.0
12	......	4.41	4.75	5.1	6.0
13	......	4.32	4.5	5.0	6.0
14	......	4.25	4.35	4.9	5.85
15	......	4.22	4.35	4.75	5.35
16	......	4.25	4.25	4.8	5.5
17	......	4.22	4.35	4.7	5.6
18	......	4.2	4.38	4.55	......
19	......	4.2	4.3	4.6	......
20	......	4.1	4.35	4.65	......
21	......	4.12	4.25	4.48	......
22	4.25	4.12	4.1	4.5	......
23	4.16	4.16	4.12	4.5	......
24	4.05	4.1	4.25	4.42	......
25	4.11	4.12	4.6	4.6	......
26	4.15	4.1	5.25	4.6	......
27	4.25	4.12	5.45	4.6	......
28	4.02	4.18	5.5	4.6	......
29	3.95	4.2	5.4	4.55	......
30	3.5	4.12	5.35	4.48	......
31	4.05	......	5.05	......	......

Daily gage height, in feet, of St. Regis River at Brasher Center, N. Y., for 1911.
[George Myers, observer.]

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	5.7	6.2	4.75	4.55	4.28	4.15	4.42	4.48	5.3
2	......	5.55	6.7	4.7	4.5	4.25	4.05	4.45	4.7	5.3
3	......	5.6	6.3	4.8	4.55	4.1	4.02	4.42	4.75	5.1
4	......	5.4	6.2	4.8	4.6	4.08	4.05	4.6	4.6	4.95
5	......	5.15	5.9	4.75	4.55	4.15	4.1	5.0	4.5	4.85
6	......	8.2	5.8	4.8	4.48	4.22	4.15	5.2	4.5	4.7[illegible]
7	......	8.7	5.55	4.85	4.6	4.29	4.75	5.1	4.6	4.8
8	......	8.8	5.5	4.65	4.45	4.28	4.8	4.95	4.9	4.7
9	......	7.2	5.4	4.7	4.48	4.2	4.7	4.8	5.1	4.95
10	......	6.6	5.35	4.9	4.41	4.32	4.45	4.7	5.05	5.1[illegible]
11	......	6.4	5.3	4.65	4.42	4.15	4.3	4.45	5.05	5.35
12	......	6.2	5.3	4.8	4.45	4.05	4.38	4.4	5.05	5.5[illegible]
13	......	6.4	5.1	4.9	4.18	4.19	4.35	4.55	4.85	6.1
14	......	6.7	5.05	5.1	4.15	4.12	4.38	4.48	4.85	6.1
15	......	6.8	5.15	5.15	4.08	4.08	4.45	4.38	4.8	5.8
16	......	6.8	4.55	5.25	4.15	4.15	4.38	4.36	4.75	5.7
17	......	6.8	4.85	5.1	4.08	4.12	4.32	4.38	4.8	5.35
18	......	6.6	4.7	4.95	4.32	4.09	4.28	4.45	4.9	5.3
19	......	6.1	4.75	4.7	4.25	4.12	4.4	4.55	5.15	5.4
20	......	6.2	4.55	4.6	4.35	4.25	4.4	4.06	5.1	5.3
21	......	5.95	4.6	4.7	4.22	4.3	4.38	4.5	5.05	5.25
22	......	6.2	4.65	4.8	4.19	4.25	4.25	4.5	5.05	5.2
23	......	6.2	4.8	4.65	4.1	4.22	4.22	4.45	4.9	5.55
24	......	6.0	4.7	4.5	4.08	4.22	4.25	4.48	4.49	5.6
25	......	6.0	5.95	4.38	4.15	4.3	4.22	4.35	4.8	5.4
26	......	6.2	5.55	4.38	4.05	4.21	4.35	4.45	4.7	5.4
27	......	6.3	5.25	4.6	4.18	4.32	4.7	4.44	4.7	5.3
28	8.0	6.2	5.05	4.6	3.98	4.15	5.0	4.42	4.75	5.3
29	6.9	6.3	5.05	4.55	4.09	4.35	4.42	4.41	5.2	5.6
30	6.2	6.2	4.85	4.6	3.95	4.32	4.35	4.38	5.35	5.8
31	5.8	......	4.75	......	3.98	4.38	......	4.48	......	5.95

Daily gage height, in feet, of St. Regis River at Brasher Center, N. Y., for 1911.

[Joseph Vanier, observer.]

DAY.	Jan.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.3	7.7	5.35	6.5	4.17	4.26	4.4	5.3	4.65	4.85
2	6.6	7.2	5.3	6.2	4.17	4.28	4.48	5.1	4.6	5.1
3	6.8	6.8	5.15	6.0	4.13	4.22	4.75	5.0	4.65	6.4
4	7.0	6.6	4.9	5.7	4.06	4.32	4.8	4.9	4.7	5.6
5	7.0	6.6	4.9	5.5	4.03	4.45	4.8	4.75	4.6	5.5
6	7.4	8.4	5.0	5.35	4.13	4.5	4.9	4.6	4.6	5.5
7	......	8.0	5.05	5.25	4.13	4.46	4.95	4.6	4.7	5.4
8	......	7.2	5.15	5.25	4.05	4.48	4.9	4.55	6.0	5.3
9	......	6.7	5.15	5.2	4.03	4.38	4.8	4.48	5.95	5.2
10	......	6.5	5.15	5.0	4.01	4.3	4.6	4.4	5.8	5.1
11	......	6.2	5.15	4.9	4.05	4.29	4.7	4.45	5.5	5.0
12	......	6.2	5.05	4.85	4.03	4.26	4.7	4.5	5.25	5.0
13	......	6.2	5.0	4.9	3.99	4.3	4.65	4.6	5.15	5.15
14	......	5.9	5.05	4.9	3.95	4.32	4.6	4.7	5.5	5.3
15	......	6.0	5.05	4.85	3.97	4.3	4.5	4.7	5.5	5.35
16	......	6.9	4.95	4.8	4.05	4.3	4.7	4.6	5.4	4.9
17	......	6.7	5.0	4.7	4.07	4.22	4.9	4.6	5.3	5.1
18	......	6.7	5.25	4.7	4.03	4.18	4.9	4.5	5.2	5.25
19	......	6.7	5.35	4.65	3.99	4.2	4.9	4.5	5.1	5.0
20	......	6.6	5.25	4.44	3.95	4.18	5.1	4.48	5.0	5.1
21	......	6.4	4.85	4.5	4.0	4.16	5.15	4.35	4.9	5.5
22	......	5.5	5.6	4.46	4.27	4.15	5.1	4.18	4.9	5.85
23	......	5.9	5.6	4.43	4.37	4.18	5.1	4.28	4.95	6.2
24	......	6.2	5.6	4.37	4.37	4.22	5.15	4.42	4.95	6.2
25	......	6.3	5.45	4.35	4.18	4.25	5.2	4.85	4.95	6.2
26	......	5.9	5.25	4.34	4.15	4.35	5.1	5.1	4.9	6.1
27	......	5.95	5.15	4.3	4.1	4.75	5.1	5.2	4.8	5.95
28	......	5.6	5.05	4.27	4.04	4.9	5.1	5.1	4.75	5.75
29	......	5.35	6.2	4.27	4.08	4.7	5.2	4.9	4.8	5.6
30	......	5.5	7.2	4.19	4.22	4.5	5.3	4.8	4.75	5.6
31	......	......	7.2	......	4.25	4.42	......	4.6	......	5.9

NOTE.— Relation of gage height to discharge affected by ice from about December 7, 1910, to March 27, 1911, and December 29, 1911, to March 31, 1912. There was backwater from an ice jam April 6 to 8, 1911.

Daily discharge, in second-feet, of St. Regis River at Brasher Center, N. Y., for 1910.

DAY.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	250	250	897	455	17	......	309	400	722	......
2	......	238	238	897	616	18	......	296	423	569	......
3	......	309	238	722	569	19	......	296	362	616	......
4	......	284	329	834	722	20	......	238	400	669	......
5	......	273	377	834	834	21	......	250	329	505	......
6	......	309	438	960	722	22	329	250	238	522	......
7	......	1,240	1,390	1,100	......	23	273	273	250	522	......
8	......	1,390	1,900	960	......	24	213	238	329	455	......
9	......	1,030	1,720	834	......	25	244	250	616	616	......
10	......	722	1,390	834	......	26	267	238	1,470	616	......
11	......	569	1,030	1,170	......	27	329	250	1,810	616	......
12	......	446	778	1,240	......	28	198	284	1,900	616	......
13	......	377	522	1,100	......	29	166	296	1,720	569	......
14	......	329	400	960	......	30	30	250	1,640	505	......
15	......	309	400	778	......	31	213	......	1,170	......	......
16	......	329	329	834	......						

Daily discharge, in second-feet, of St. Regis River at Brasher Center, N. Y., for 1911.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,530	3,740	925	690	438	342	561	619	1,760
2	2,130	5,440	860	638	415	279	590	860	1,760
3	2,330	4,040	990	690	308	262	561	925	1,430
4	1,940	3,740	990	742	296	279	742	742	1,200
5	1,510	2,960	925	690	342	308	1,270	638	1,060
6	10,000	2,740	990	619	392	342	1,590	638	860
7	10,000	2,230	1,060	742	446	925	1,430	742	990
8	9,000	2,130	801	590	438	990	1,200	1,130	860
9	7,450	1,940	860	619	376	860	990	1,430	1,200
10	5,060	1,850	1,130	552	472	590	860	1,350	1,430
11	4,360	1,760	801	561	342	454	590	1,350	1,850
12	3,740	1,760	990	590	279	524	542	1,350	2,130
13	4,360	1,430	1,130	362	369	498	690	1,060	3,460
14	5,440	1,350	1,430	342	322	524	619	1,060	3,460
15	5,830	1,510	1,510	296	296	590	524	990	2,740
16	5,830	690	1,680	342	342	524	507	925	2,530
17	5,830	1,060	1,430	296	322	472	524	990	1,850
18	5,060	860	1,200	472	302	438	590	1,130	1,760
19	3,460	925	860	415	322	542	690	1,510	1,940
20	3,740	690	742	498	415	542	285	1,430	1,760
21	3,080	742	860	392	454	524	638	1,350	1,680
22	3,740	801	990	369	415	415	638	1,350	1,590
23	3,740	990	801	308	392	392	590	1,130	2,230
24	3,200	860	638	296	392	415	619	628	2,330
25	3,200	3,080	524	342	454	392	498	990	1,940
26	3,740	2,230	524	279	384	498	590	860	1,940
27	4,040	1,680	742	362	472	860	580	860	1,760
28	3,740	1,350	742	240	342	1,270	561	925	1,760
29	4,040	1,350	690	302	498	561	552	1,590	[1,700]
30	3,740	1,060	742	225	472	498	524	1,850	[1,700]
31	......	925	......	240	524	......	619	......	[1,700]

Daily discharge, in second-feet, of St. Regis River at Brasher Center, N. Y., for 1912.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9,630	1,850	4,700	356	423	542	1,760	801	1,060
2	7,450	1,760	3,740	356	438	619	1,430	742	1,430
3	5,830	1,510	3,200	328	392	925	1,270	801	4,360
4	5,060	1,130	2,530	285	472	990	1,130	860	2,330
5	5,060	1,130	2,130	267	590	990	925	742	2,130
6	12,900	1,270	1,850	328	638	1,130	742	742	2,130
7	11,000	1,350	1,680	328	600	1,200	742	860	1,940
8	7,450	1,510	1,680	279	619	1,130	690	3,200	1,760
9	5,440	1 510	1,590	267	524	990	619	3,080	1,590
10	4,700	1,510	1,270	256	454	742	542	2,740	1,430
11	3,740	1,510	1,130	279	446	860	590	2,130	1,270
12	3,740	1,350	1,060	267	423	860	638	1,680	1,270
13	3,740	1,270	1,130	245	454	801	742	1,510	1 510
14	2,960	1,350	1,130	225	472	742	860	2,130	1,760
15	3 200	1,350	1,060	235	454	638	860	2,130	1,850
16	6,220	1,200	990	279	454	860	742	1,940	1,130
17	5,440	1,270	860	291	392	1,130	742	1,740	1,430
18	5,440	1,680	860	267	362	1,130	638	1,590	1,680
19	5,440	1,850	801	245	376	1,130	638	1,430	1,270
20	5,060	1,680	580	225	362	1,430	619	1,270	1,430
21	4,360	1,060	638	250	349	1,510	498	1,130	2,130
22	2,130	2,330	600	431	342	1,430	362	1,130	2,850
23	2,960	2,330	571	516	362	1,430	438	1,200	3,740
24	3,740	2,380	516	516	392	1,510	561	1,200	3,740
25	4,040	2,040	498	362	415	1,590	1,060	1,200	3,740
26	2,960	1,680	489	342	498	1,430	1,430	1,130	3,460
27	3,080	1,510	454	308	925	1,430	1,590	990	3,080
28	2,330	1,350	431	273	1,130	1,430	1,430	925	2,640
29	1,850	3,740	431	296	860	1,590	1,130	990	2,330
30	2,130	7,450	369	392	638	1,760	990	925	2,330
31	......	7,450	......	415	561	......	742	......	2,960

NOTE.— Daily discharge for 1910 determined from a rating curve based on one measurement and the shape of the rating curve for 1911–1912.

Daily discharge for 1911 and 1912, determined from a rating curve well defined below 7,000 second-feet.

Daily discharge, April 6 to 8, 1911, estimated on account of ice jams.

Monthly discharge of St. Regis River at Brasher Center, N. Y., for 1910.
[Drainage area 621 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
August 22–31	329	30	226	.364	.14	B
September	1,390	238	404	.651	.73	B
October	1,900	238	800	1.29	1.49	B
November	1,240	455	769	1.24	1.38	B
December	....	....	700	1.13	1.30	D

Monthly discharge of St. Regis River at Brasher Center, N. Y., for 1911.
[Drainage area, 621 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	1,250	2.01	2.32	D
February	....	....	730	1.18	1.23	D
March	....	....	1,600	2.58	2.97	D
April	....	1,510	4,530	7.29	8.13	C
May	5,440	690	1,870	3.01	3.47	A
June	1,680	524	952	1.53	1.71	A
July	742	225	455	.733	.85	A
August	524	279	388	.625	.72	A
September	1,270	262	537	.865	.97	A
October	1,590	285	702	1.13	1.30	A
November	1,850	619	1,080	1.74	1.94	A
December	3,460	860	1,820	2.93	3.38	B
The year	....	....	1,330	2.14	28.90	

Monthly Discharge of St. Regis River at Brasher Center, N. Y., for 1912.
[Drainage area, 621 square miles.]

MONTH.	Discharge in Second Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	....	....	780	1.26	1.45	D
February	....	....	370	.596	.64	D
March	....	....	460	.741	.85	D
April	12,900	1,850	4,970	8.00	8.93	B
May	7,450	1,060	2,010	3.24	3.74	A
June	4,700	369	1,300	2.09	2.33	A
July	516	225	313	.504	.58	A
August	1,130	342	510	.821	.95	A
September	1,760	542	1,130	1.82	2.03	A
October	1,760	362	876	1.41	1.63	A
November	3,200	742	1,430	2.30	2.57	A
December	4,360	1,060	2,190	3.53	4.07	A
The year	12,900	....	1,360	2.19	29.77	

NOTE.— Discharge for December 7, 1910, to March 31, 1911, and December 29, 1911, to March 31, 1912, estimated by means of comparison with the flow of Raquette and Oswegatchie Rivers. Mean discharge, December 7 to 31, 1910, estimated, 710 second-feet.

Deer River at Ironton, N. Y.

Location.— About 1000 feet above steel highway bridge in the village of Brasher Iron Works (R. R. station is Ironton) and two miles above the confluence of Deer river with St. Regis river in Helena. There are no important tributaries between the gage and the mouth of the river. A small creek enters from the left about one mile above the station.

Records available.— July 25th to December 31, 1912.

Drainage area.— 206 square miles (From Post Route Map.)

Gage.— Wooden sloping gage, 32 feet long, reading from .5 to 11.0 feet. This gage is about 1,000 feet below the bridge and 500 feet below the remains of an old wooden dam. An auxiliary vertical staff gage, fastened on the upstream side of the right abutment, is to be used as a reference while making measurements and to determine the effect of the removal of the dam below.

Channel.— The stream bed at the bridge is solid rock and smooth. There is a gravel control about 300 feet below the gage which is probably permanent.

Discharge measurements.— Measurements during medium and high stages are made from the bridge and those at low stages are made by wading a short distance above.

Winter flow.— Relation of gage height to discharge will probably be affected by ice during the winter months.

Accuracy.— Rating curve good for low stages. Upper portion not covered by any measurements. Estimates as published, good.

Co-operation.— Station established and maintained in co-operation with the United States Geological Survey. Gage heights furnished by M. W. Lantry, Hogansburg, N. Y.

Discharge measurements of Deer River at Ironton, in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 25 a	G. H. Canfield	1.13	51.3
Oct. 22	J. G. Mathers	1.68	130
25	do	2.66	397

a Made by wading above the bridge.

Daily gage height, in feet, of Deer River at Ironton, N. Y., for 1912.

[Alex. Barlow, observer.]

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.39	1.49	2.85	1.9	2.3	17	.....	1.28	2.2	1.71	3.1	2.7
2	.....	1.38	1.66	2.5	2.0	4.8	18	.....	1.15	2.1	1.61	2.95	2.85
3	.....	1.35	1.85	2.3	1.92	5.8	19	.....	1.12	2.5	1.68	2.6	3.8
4	.....	1.52	1.80	2.2	1.8	3.3	20	.....	1.06	2.8	1.74	2.7	3.2
5	.....	1.64	1.72	2.05	1.75	3.0	21	.....	1.19	2.8	1.61	2.6	3.4
6	.....	1.58	1.60	1.91	1.7	3.1	22	.....	1.16	2.45	1.62	2.4	3.4
7	.....	1.49	1.88	1.95	2.1	3.0	23	.....	1.20	2.3	1.58	2.25	3.4
8	.....	1.44	2.4	1.78	5.8	2.45	24	.....	1.19	2.8	1.60	2.2	3.5
9	.....	1.44	2.1	1.70	4.0	2.25	25	1.12	1.52	2.65	2.4	2.1	3.8
10	.....	1.46	1.99	1.76	3.3	2.5	26	1.09	1.69	2.5	2.7	2.25	3.7
11	.....	1.42	1.95	1.75	2.8	2.45	27	1.10	2.15	3 1	2.45	2.35	3.6
12	.....	1.31	2.2	1.80	2.6	2.55	28	1.11	2.05	2.7	2.25	2.3	3.6
13	.....	1.44	1.92	2.1	2.5	2.65	29	1.22	1.72	2.75	2.1	2.35	3.4
14	.....	1.42	1.89	1.98	4.1	2.9	30	1.36	1.44	3.5	2.55	2.55	3.3
15	.....	1.35	1.85	1.88	3.6	2.6	31	1.35	1.64	.....	1.95	.....	3.9
16	.....	1.31	2.55	1.78	3.3	2.5							

Daily discharge, in second-feet, of Deer River at Ironton, N. Y., for 1912.

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	84	98	465	175	279	17	.....	69	251	135	566	410
2	.....	82	126	341	199	1680	18	.....	54	225	117	504	465
3	.....	78	164	279	180	2810	19	.....	51	341	129	375	920
4	.....	102	153	251	153	656	20	.....	45	446	141	410	640
5	.....	122	137	212	143	524	21	.....	58	446	117	375	704
6	.....	112	115	177	133	566	22	.....	55	325	119	309	704
7	.....	98	171	187	225	524	23	.....	59	279	113	265	704
8	.....	91	309	149	2810	325	24	.....	58	446	115	251	754
9	.....	91	225	133	1060	265	25	51	102	392	309	225	920
10	.....	93	197	145	656	341	26	48	131	341	410	265	864
11	.....	88	187	143	446	325	27	49	238	566	325	294	866
12	.....	72	251	153	375	358	28	50	212	410	265	279	808
13	.....	91	180	225	341	392	29	61	137	428	225	294	704
14	.....	88	173	194	1120	484	30	79	91	754	258	358	656
15	.....	78	164	171	808	375	31	78	122	.....	187	.....	980
16	.....	72	358	149	656	341							

NOTE.— Daily discharge determined from a well defined rating curve.

Monthly discharge of Deer River at Ironton, N. Y., for 1912.
[Drainage area, 206 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
July 25–31	79	48	59.4	.288	.07	A
August	238	45	94.3	.458	.53	A
September	754	98	289.	1.40	1.56	A
October	465	113	208.	1.01	1.16	A
November	2810	133	475.	2.31	2.58	A
December	2810	265	686.	3.33	3.84	A

AUSABLE RIVER DRAINAGE BASIN.

Description.

The Ausable river is formed by the junction of the east and west branches which have their headwaters in the northwestern part of Essex county. The east branch has its source in upper Ausable lake, at an elevation of 1,990 feet above sea level. The west branch is formed by several small streams which lie in the valley to the west and north of the east branch. Both branches flow north and east to their junction in the village of Ausable Forks, from which point the river flows northeast, entering Lake Champlain about 10 miles south of Plattsburg and opposite and slightly north of the city of Burlington.

Throughout the entire course, the river is fed by small mountain streams, which enter at nearly right angles from the mountains on either side. There are few lakes in this drainage area to act as a regulator on the flow and, owing to the great differences of elevation throughout the area, the stream has what is called a flashy discharge, its fluctuations being large and rapid.

Owing to the fact that this basin lies on the eastern slope of the Adirondack mountains, the average rain fall is less than for those basins whose streams rise on the western and southern slopes, the mean yearly precipitation being about 32 inches.

About 6,000 water horsepower is developed at the present time, principally on the west branch. For additional development and storage possibilities on this stream see Fifth Annual Report of Water Supply Commission, pages 88, 147, 267.

Ausable River at Ausable Forks, N. Y.

Location.— In the village of Ausable Forks, immediately below the junction of the east and west branches and about 15 miles above the mouth of the river.

Records available.— August 17, 1910, to December 31, 1912. Data also in annual reports of the United States Geological Survey and the State Water Supply Commission of New York.

Drainage area.— 487 square miles. (From U. S. G. S. Topographic sheets and Post Route map.)

Gage.— Chain, on the left bank, about 100 feet below the junction of east and west branches of Ausable river; read twice daily; datum unchanged.

Channel.— Sand and gravel; liable to shift. Divided by an island.

Discharge measurements.— Made from a cable about 1½ miles below the gage. At this place the river flows in one channel.

Winter flow.— Ice may form on the riffles below the gage and either divert or cause back water.

Accuracy.— Conditions at the measuring section good. Very good rating curve developed. Estimates good.

Discharge measurements of Ausable River at Ausable Forks, N. Y., in 1912.

DATE.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 28 *a*	G. H. Canfield	3.62	183
April 9	Frank Weber	5.00	2,340
10	do	4.55	1,430
17	C. C. Covert	6.02	5,270
May 13 *b*	Frank Weber	4.44	1,290
July 29	G. H. Canfield	3.59	162

a Made under complete ice cover at cable; river nearly open at gage and just below.
b A very sudden rise took place near the finish of this measurement.

Daily gage height, in feet, of Ausable River at Ausable Forks, N. Y., for 1910.
[H. Edward Miner, observer.]

DAY.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	3.6	3.66	3.78	3.72	17	3.76	3.64	3.62	3.72	3.9
2	......	3.6	3.66	3.72	3.72	18	3.67	3.61	3.66	3.7	3.88
3	......	3.61	3.83	3.76	3.68	19	3.74	3.62	3.62	3.8	4.02
4	......	3.68	3.74	3.87	3.7	20	3.68	3.59	3.64	3.69	3.9
5	......	3.82	3.74	4.08	3.73	21	3.64	3.61	3.61	3.84	3.77
6	......	4.38	3.78	4.22	3.73	22	3.64	3.6	3.62	3.8	3.88
7	......	4.09	3.96	4.12	3.86	23	3.62	3.62	3.64	3.76	3.86
8	......	3.66	3.9	3.82	3.8	24	3.62	3.6	3.68	3.73	3.82
9	......	3.66	3.8	3.74	3.72	25	3.62	3.56	3.72	3.77	3.88
10	......	3.72	3.83	3.82	3.83	26	3.62	3.58	3.66	3.74	4.12
11	......	3.56	3.93	3.82	3.73	27	3.59	3.7	3.8	3.68	3.84
12	......	3.72	3.82	3.9	3.86	28	3.59	3.69	4.41	3.74	3.74
13	......	3.62	3.72	3.78	3.87	29	3.62	3.67	4.13	3.68	3.78
14	......	3.62	3.74	3.77	3.96	30	3.58	3.7	3.8	3.73	3.78
15	......	3.6	3.68	3.76	4.02	31	3.56	......	3.76	......	4.14
16	......	3.61	3.62	3.83	3.97						

Daily gage height, in feet, of Ausable River at Ausable Forks, N. Y., for 1911.
[H. Edward Miner, observer.]

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	3.82	3.9	5.7	3.87	3.69	3.52	3.61	3.64	3.7	3.98
2	......	3.65	3.97	7.1	4.01	3.59	3.53	3.57	3.72	3.77	3.89
3	......	3.92	3.99	5.15	3.87	3.67	3.53	3.57	3.68	3.78	3.76
4	......	3.63	4.03	4.7	3.79	3.6	3.54	3.57	3.7	3.76	3.84
5	......	3.65	3.84	4.35	3.81	3.58	3.5	3.58	4.35	3.63	3.78
6	......	3.76	5.05	4.25	3.71	3.58	3.49	4.0	4.16	3.67	3.76
7	......	3.88	5.9	4.3	3.77	3.6	3.56	4.18	3.94	3.77	3.7
8	......	3.66	5.0	4.65	3.67	3.57	3.58	3.84	3.75	4.13	3.71
9	......	3.65	4.27	4.8	3.88	3.53	3.6	3.63	3.78	4.0	3.75
10	......	3.62	4.33	4.8	3.94	3.57	3.55	3.64	3.76	3.88	3.65
11	......	3.63	4.29	4.65	3.91	3.56	3.56	3.62	3.76	3.88	3.99
12	......	3.66	4.3	4.75	3.99	3.52	3.51	3.64	3.69	3.95	4.7
13	......	3.92	4.48	4.55	4.5	3.56	3.52	3.66	3.64	4.43	5.7
14	......	3.86	5.1	4.14	4.31	3.48	3.53	3.62	3.63	4.07	4.85
15	......	3.9	5.6	4.09	4.17	3.48	3.52	3.62	3.64	3.91	4.44
16	......	4.02	5.0	3.93	4.23	3.54	3.56	3.67	3.63	3.82	4.18
17	......	3.98	4.6	4.47	4.15	3.56	3.52	3.61	3.58	3.8	4.15
18	......	3.72	4.45	3.94	3.95	3.61	3.5	3.7	3.69	3.84	4.05
19	......	3.64	4.28	4.09	3.83	3.7	3.48	3.62	4.36	3.86	3.88
20	......	3.68	4.38	4.07	3.79	3.62	3.54	3.62	4.19	3.8	4.14
21	......	3.73	4.34	3.91	3.76	3.56	3.66	3.56	4.05	3.78	3.99
22	......	3.7	4.28	3.97	3.73	3.56	3.53	3.66	4.1	3.72	3.8
23	......	3.82	4.28	3.92	3.71	3.49	3.56	3.62	4.2	3.68	4.55
24	......	4.7	4.22	4.03	3.75	3.53	3.55	3.58	4.06	3.74	4.7
25	3.63	3.91	4.44	4.11	3.55	3.54	3.62	3.72	3.92	3.76	4.28
26	3.66	4.18	4.75	4.09	3.85	3.6	3.55	3.64	3.82	3.51	4.14
27	3.92	4.46	4.95	3.95	3.69	3.79	3.54	3.68	3.78	3.65	3.97
28	4.07	4.85	5.35	3.83	3.66	3.55	3.56	3.62	3.77	3.69	3.92
29	......	4.36	5.6	3.83	......	3.55	3.64	3.64	3.66	4.02	4.22
30	......	4.14	5.6	3.72	......	3.55	3.68	3.68	3.66	4.02	4.7
31	......	3.98	......	3.69	......	3.6	3.63	......	3.69	......	4.7

Daily gage height, in feet, of Ausable River at Ausable Forks, N. Y., for 1912 [a]
[A. S. Baker, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.3	3.6	3.68	4.56	4.08	4.85	3.56	3.56	3.68	4.32	3.94	3.86
2	4.34	3.6	3.65	4.34	4.24	4.5	3.33	3.56	3.96	4.14	4.22	3.91
3	4.28	3.64	3.66	4.04	4.16	4.36	3.54	3.62	3.98	3.98	4.0	4.75
4	4.14	3.6	3.67	3.98	4.14	4.28	3.43	3.64	3.84	3.92	3.95	4.45
5	4.06	3.74	3.66	4.41	4.04	4.19	4.06	3.68	3.84	3.8	3.9	4.26
6	3.95	3.59	3.64	5.7	4.35	4.07	3.68	3.69	4.04	3.82	3.9	4.44
7	3.82	3.58	3.68	7.2	4.6	4.05	3.68	3.66	4.04	3.78	3.92	4.65
8	3.96	3.60	3.63	6.3	4.7	3.98	3.67	3.64	3.98	3.72	5.9	4.30
9	3.88	3.72	3.66	4.9	4.55	3.9	3.64	3.62	3.84	3.64	5.0	4.05
10	3.94	3.68	3.65	4.6	4.4	3.88	3.6	3.61	3.72	3.72	4.6	4.12
11	3.96	3.6	3.57	4.4	4.21	3.84	3.72	3.63	3.82	3.77	4.1	4.04
12	4.11	3.64	3.58	4.3	4.26	3.82	3.75	4.0	3.84	3.76	4.0	3.93
13	4.02	3.6	3.62	4.34	4.6	3.8	3.58	3.79	3.76	4.34	4.28	3.97
14	4.0	3.57	3.59	4.34	4.7	3.78	3.64	3.76	3.7	4.08	4.55	3.96
15	3.78	3.56	3.6	5.25	4.35	3.82	3.73	3.72	3.61	4.0	4.75	3.86
16	3.86	3.56	3.66	6.6	4.2	3.82	3.64	3.72	4.02	3.94	4.6	3.87
17	3.86	3.58	3.92	5.9	4.9	3.7	3.61	3.68	4.14	3.82	4.28	3.97
18	3.82	3.53	4.08	4.8	4.75	3.75	3.6	3.58	3.92	3.81	4.2	3.98
19	3.72	3.6	4.17	5.4	4.45	3.72	3.59	3.63	4.41	3.84	4.01	4.25
20	3.67	3.56	4.44	4.9	4.34	3.74	3.58	3.63	4.7	3.93	4.01	3.8
21	3.61	3.6	4.22	4.6	6.1	3.67	3.33	3.57	4.6	3.82	4.0	3.18
22	3.71	3.6	4.04	4.6	5.9	3.71	3.77	3.57	4.4	3.74	3.95	3.14
23	3.64	3.88	3.86	6.2	5.1	3.68	3.78	3.56	4.08	3.79	3.96	4.02
24	3.6	3.64	3.7	5.05	4.65	3.63	3.71	3.54	4.18	4.38	3.95	4.12
25	3.66	3.62	3.72	4.7	4.7	3.6	3.66	3.58	4.03	6.0	3.99	4.18
26	3.7	3.7	3.76	4.4	4.6	3.58	3.62	3.66	4.01	4.95	3.96	4.15
27	3.7	3.64	3.68	4.6	4.26	3.64	3.53	3.96	3.89	4.6	3.94	4.08
28	3.64	3.6	3.74	4.7	4.26	3.56	3.54	3.99	3.88	4.35	3.92	3.92
29	3.81	3.64	4.24	4.4	4.7	3.56	3.58	3.88	3.94	4.16	3.91	3.84
30	3.75	......	4.31	4.2	5.7	3.54	3.62	3.82	4.6	4.0	3.88	3.8
31	3.7	......	4.32	......	5.2	......	3.56	3.72	......	3.98	......	3.82

[a] NOTE.— Daily gage height for 1910 and 1911 was published in the First Annual Report of the Conservation Commission. Relation of gage height to discharge affected by ice February 25 to about March 23, 1911, and January 6 to March 15, 1912. There may have been some ice effect during the latter part of December, 1910.

Daily discharge, in second-feet, of Ausable River at Ausable Forks, N. Y., for 1910.

DAY.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	Aug.	Sept.	Oct.	Nov.	Dec
1	......	194	231	348	292	17	329	226	210	292	473
2	......	194	231	292	292	18	249	202	231	273	452
3	......	202	399	329	257	19	311	210	210	367	616
4	......	257	311	441	273	20	257	187	226	265	473
5	......	388	311	694	301	21	226	202	202	409	339
6	......	1,130	348	889	301	22	226	194	210	367	452
7	......	707	543	748	431	23	210	210	226	329	431
8	......	231	473	388	367	24	210	194	257	301	388
9	......	231	367	311	292	25	210	167	292	339	452
10	......	292	399	388	399	26	210	181	241	311	748
11	......	167	508	388	301	27	187	273	367	257	409
12	......	292	388	473	431	28	187	265	1,180	311	311
13	......	210	292	348	441	29	210	249	762	257	348
14	......	210	311	339	543	30	181	273	367	301	348
15	......	194	257	329	616	31	167	......	329	......	776
16	......	202	210	399	555						

Daily discharge, in second-feet, of Ausable River at Ausable Forks, N. Y., for 1911.

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	330	473	4,250	441	265	140	202	226	273	566
2	......	199	555	9,130	603	187	147	174	292	339	462
3	......	422	578	2,690	441	249	147	174	257	348	329
4	......	185	629	1,700	358	194	154	174	273	329	409
5	......	199	409	1,080	378	181	127	181	1,080	218	348
6	......	296	2,450	932	282	181	122	590	804	249	329
7	......	407	4,880	1,000	339	194	167	832	520	339	273
8	......	217	2,340	1,600	249	174	181	409	320	762	282
9	......	211	962	1,900	452	147	194	218	348	590	320
10	......	189	1,050	1,900	520	174	160	226	329	452	234
11	......	196	990	1,600	485	167	167	210	329	452	578
12	......	217	1,000	1,800	578	140	134	226	265	531	1,700
13	......	446	1,300	1,420	1,330	167	140	241	226	1,210	4,250
14	......	388	2,570	776	1,020	117	147	210	218	681	2,000
15	......	426	3,940	707	818	117	140	210	226	485	1,230
16	......	585	2,340	508	904	154	167	249	218	388	832
17	......	538	1,510	1,280	790	167	140	202	181	367	790
18	......	277	1,250	520	532	202	127	273	265	409	655
19	......	215	976	707	399	273	117	210	1,100	430	452
20	......	245	1,130	681	358	210	154	210	846	367	776
21	......	286	1,070	485	329	167	241	167	655	348	578
22	......	259	976	555	301	167	147	241	720	292	367
23	......	369	976	496	282	122	167	210	860	257	1,420
24	......	1,700	889	629	320	147	160	181	668	311	1,700
25	183	485	1,230	734	160	154	210	292	496	329	976
26	205	832	1,800	707	420	194	160	226	388	134	776
27	422	1,260	2,220	532	265	358	154	257	348	234	554
28	578	2,000	3,210	399	241	160	167	210	339	265	496
29	......	1,100	3,940	399	249	160	226	226	241	616	889
30	......	776	3,940	292	257	160	257	257	241	616	1,700
31	......	567	......	265	......	194	218	......	265	......	1,700

Daily discharge, in second-feet, of Ausable River at Ausable Forks, N. Y., for 1912.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1,000	155	218	1,440	694	2,000	167	167	257	1,040	520	431
2.....	1,070	155	199	1,070	918	1,330	51	167	543	776	889	485
3.....	976	181	205	642	804	1,100	154	210	567	567	590	1,800
4.....	776	155	211	567	776	976	92	226	409	496	532	1,250
5.....	668	249	205	1,180	642	846	668	257	409	367	473	947
6.....	426	150	192	4,250	1,080	681	257	265	642	388	473	1,230
7.....	310	145	218	9,510	1,510	655	257	241	642	348	496	1,600
8.....	434	155	185	6,210	1,700	567	249	226	567	292	4,880	1,000
9.....	362	233	205	2,110	1,420	473	226	210	409	226	2,340	655
10.....	416	205	199	1,510	1,160	452	194	202	292	292	1,510	748
11.....	434	155	148	1,160	874	409	292	218	388	339	720	642
12.....	587	181	154	1,000	947	388	320	590	409	329	590	508
13.....	493	155	178	1,070	1,510	367	181	358	329	1,070	976	555
14.....	472	139	159	1,070	1,700	348	226	329	273	694	1,420	543
15.....	278	134	165	2,940	1,080	388	301	292	202	590	1,800	431
16.....	345	134	241	7,270	860	388	226	292	616	520	1,510	441
17.....	345	145	496	4,880	2,110	273	202	257	776	388	976	555
18.....	310	118	694	1,900	1,800	320	194	181	496	378	860	567
19.....	233	165	818	3,350	1,250	292	187	218	1,180	409	603	932
20.....	199	142	1,230	2,110	1,070	311	181	218	1,700	508	603	367
21.....	162	165	889	1,510	5,530	249	51	174	1,510	388	590	14
22.....	225	165	642	1,510	4,880	282	339	174	1,160	311	532	9
23.....	181	384	431	5,870	2,570	257	348	167	694	358	543	616
24.....	155	192	273	2,450	1,600	218	282	154	832	1,130	532	748
25.....	193	178	292	1,700	1,700	194	241	181	629	5,200	578	832
26.....	218	232	329	1,160	1,510	181	210	241	603	2,220	543	790
27.....	218	192	257	1,510	947	226	147	543	462	1,510	520	694
28.....	181	165	311	1,700	947	167	154	578	452	1,080	496	496
29.....	302	192	918	1,160	1,700	167	181	452	520	804	485	409
30.....	256	......	1,020	860	4,250	154	210	388	1,510	590	452	367
31.....	218	......	1,040	......	2,820	......	167	292	......	567	......	388

NOTE. — Daily discharge determined from a well defined rating curve. During the period of ice effect, February 25 to March 23, 1911, and January 6 to March 15, 1912, coefficients varying from 80 per cent. to 95 per cent. were applied to the open water discharge. These coefficients are based on discharge measurements, but the daily discharge for these periods can be considered only approximate.

Monthly discharge of Ausable River at Ausable Forks, N. Y., for 1910.
[Drainage area, 487 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square miles.	Depth in inches on drainage area.	
August 17–31	329	167	225	.462	.26	A
September	1,180	167	271	.556	.62	A
October	1,180	202	351	.721	.83	A
November	889	257	383	.786	.88	A
December	776	257	423	.869	1.00	B

Monthly discharge of Ausable River at Ausable Forks, N. Y., for 1911.
[Drainage area, 487 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
March	1,700	185	510	1.05	1.21	B
April	4,880	473	1,720	3.53	3.94	A
May	9,130	265	1,340	2.75	3.17	A
June	1,330	160	470	.965	1.08	A
July	358	117	182	.374	.43	A
August	257	117	164	.337	.39	A
September	832	167	256	.526	.59	A
October	1,100	181	437	.897	1.03	A
November	1,210	134	421	.864	.96	A
December	4,250	234	902	1.85	2.13	A

Monthly discharge of Ausable River at Ausable Forks, N. Y., for 1912.
[Drainage area, 487 square miles.]

MONTH.	Discharge in Second-Feet.				Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January	1,070	155	401	.823	.95	B
February	384	118	176	.361	.39	B
March	1,230	148	410	.842	.97	B
April	9,510	567	2,490	5.11	5.70	A
May	5,530	642	1,690	3.47	4.00	A
June	2,000	154	489	1.00	1.12	A
July	668	51	224	.460	.53	A
August	590	154	273	.561	.65	A
September	1,700	202	649	1.33	1.48	A
October	5,200	226	780	1.60	1.84	A
November	4,880	452	934	1.92	2.14	A
December	1,800	9	679	1.39	1.60	A
The year	9,510	9	765	1.57	27.37	

Miscellaneous measurements in St. Lawrence River drainage basin in 1912.

DATE.	Stream.	Tributary to —	Locality.	Gage height.	Discharge.
				Feet.	Sec.-ft.
April 6	Canaseraga Creek	Genesee River	Shakers Crossing, N.Y.	a16.33	1,970
10	Palmer Brook	Ausable River	Ausable Forks, N.Y.	b	32.4
May 13	Palmer Brook	Ausable River	Ausable Forks, N.Y.	b	7.0
July 16	Canaseraga Creek	Genesee River	Shakers Crossing, N.Y.	a3.70	236
16	Mt. Morris Power Canal	Genesee River	Mt. Morris, N.Y.	2.52	215
29	Palmer Brook	Ausable River	Ausable Forks, N.Y.	b	1.61
Oct. 17	Beaver Brook	Black River	Stillwater dam, near Beaver River, N. Y.	c4.70	d184
18	Beaver River	Black River	Stillwater dam, near Beaver River, N.Y.	c4.70	e139
18	Beaver River	Black River	Stillwater dam, near Beaver River, N.Y.	c4.70	f263

a Datum is 25 feet below R. P. which is the top of tie-bar 20 feet from left hand abutment down stream side of bridge. Discharge includes the flow through Power Canal.
b Enters Ausable River from left just below gage.
c Gage height is distance to water surface from crest of dam.
d Gate No. 1 open (4 feet) all others closed.
e Gate No. 4 open 24 inches; all others closed.
f Gates No. 1 and 4 each open 24 inches; all others closed.

Summary of discharge, in second-feet, per square mile, for all river stations for which such data are available in this report.

STATION.	Drainage area.	1912. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	Sq. mi.													
Hudson River at North Creek, N. Y.	804	.995	1.32	1.02	7.28	4.73	1.42	.847	1.13	1.11	1.58	2.28	1.52	2.10
Hudson River at Thurman, N. Y.	1,550	1.10	.968	.839	6.37	4.11	1.44	.577	.748	.787	1.16	1.94	1.35	1.77
Hudson River at Corinth, N. Y.	2,760	1.21	.921	1.76	8.48	4.31	1.26	.438	.514	.656	1.45	2.68	1.63	2.11
Hudson River at Spier Falls, N. Y.	2,800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.22	1.74	.....
Hudson River at Mechanicville, N. Y.	4,500	1.06	.756	2.22	6.13	2.87	1.23	.291	.282	.565	1.52	2.40	1.92	1.77
Schroon River at Riverbank, N. Y.	534	1.35	.654	.682	7.19	3.99	1.66	.277	.360	.459	.732	2.15	1.50	1.74
Sacandaga River at Hope, N. Y.	494	1.21	.607	1.82	10.1	4.43	.990	.223	.184	.524	1.51	2.87	2.47	2.25
Sacandaga River at Cable Station, Hadley, N. Y.	1,060	1.01	.618	2.01	8.59	3.50	.920	.201	.180	.539	1.48	2.55	2.23	1.98
Sacandaga River, west branch, at Blackbridge, N. Y.	211	1.18	.616	1.90	11.6	5.55	1.58	.189	.178	.749	1.94	3.62	3.17	2.68
Cattaraugus Creek at Versailles, N. Y.	467	1.01	.621	4.39	5.55	1.48	.422	.413	.597	1.00	1.09	1.12	2.18	1.60
Little Tonawanda Creek at Linden, N. Y.	20.7	.....	.....	.....	.....	.....	.....	.....	.144	.076	.092	.257	.643	.....
Genesee River at St. Helena, N. Y.	1,030	.650	.397	3.40	4.71	1.23	.237	.146	.173	.471	.604	.735	.950	1.15
Genesee River at Jones' Bridge, N. Y.	1,410	.553	.411	3.19	4.33	1.19	.267	.182	.210	.497	.582	.697	.950	1.09
Genesee River at Rochester, N. Y.	2,360	.564	.406	2.88	4.24	1.21	.328	.167	.144	.276	.319	.408	.682	.966
Canaseraga Creek at Dansville, N. Y.	167	.....	.....	3.17	2.84	1.60	.558	1.09	.297	.504	.301	.442	.707	.....
Keshequa Creek at Sonyea, N. Y.	67	.....	.....	3.06	3.34	.61	.106	.112	.073	.133	.155	.246	.560	.....
Owasco Outlet, near Auburn, N. Y.	206	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.05	1.24	.....
Salmon River at Stillwater, N. Y.	191	1.31	1.05	1.69	15.4	5.92	1.53	.529	.654	1.74	3.03	3.08	4.47	3.36
Salmon River near Pulaski, N. Y.	260	1.31	1.04	1.69	16.0	5.81	1.73	.527	.592	1.71	3.01	3.32	4.04	3.38
Orwell Brook near Altmar, N. Y.	22.1	.....	.....	.....	10.5	3.21	1.37	.539	.813	1.32	2.06	2.59	3.30	.....
Black River near Boonville, N. Y.	303	1.55	1.14	3.11	9.90	4.75	1.27	.196	.172	.878	1.12	2.24	2.66	2.41
Moose River at Moose River, N. Y.	370	1.30	.724	1.45	7.30	5.24	1.54	.581	.654	1.05	2.00	2.76	2.14	2.23
Middle Branch, Moose River at Old Forge, N. Y.	51.5	1.85	2.29	1.72	4.49	4.08	1.17	1.24	1.29	1.90	2.15	2.90	2.78	2.31
Oswegatchie River near Ogdensburg, N. Y.	1,580	1.19	.532	1.32	6.33	2.58	3.19	.434	.387	.835	1.27	3.11	3.53	2.05
East Branch, Oswegatchie River at Newton Falls, N. Y.	194	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.72	2.03	.....
Raquette River at Raquette Falls, N. Y.	418	1.80	.737	.610	6.05	5.38	2.46	.388	.435	.844	1.27	.....	.....	.....
Raquette River at Piercefield, N. Y.	723	1.67	.769	.585	3.15	4.61	2.41	.459	.441	.593	1.18	2.61	1.91	1.69
Raquette River at Massena Springs, N. Y.	1,170	1.28	.652	.831	5.32	4.22	2.62	.409	.441	.758	1.03	2.36	3.37	1.94
Bog River near Tupper Lake, N. Y.	132	.....	.....	.....	5.75	3.75	2.20	.....	.....	.....	.....	.....	.....	.....
St. Regis River at Brasher Center, N. Y.	621	1.26	.596	.741	8.00	3.24	2.09	.504	.821	1.82	1.41	2.30	3.53	2.19
Deer River at Ironton, N. Y.	206	.....	.....	.....	.....	.....	.....	.288	.458	1.40	1.01	2.31	3.33	.....
Ausable River at Ausable Forks, N. Y.	487	.823	.361	.842	5.11	3.47	1.00	.460	.561	1.33	1.60	1.92	1.39	1.57

RAIN FALL STUDIES.

The following tables give the results of observations taken at the various meteorologic stations maintained during 1912. These records show, in a general way, the amount of precipitation that fell during each month in New York State, together with the minimum, maximum, and mean temperatures at certain stations.

The records during the winter months are very difficult to obtain and in most cases can be considered as only approximate. An effort is being made to improve this part of the work by the use of snow tubes and density buckets, with scales for translating the depth of snow in inches into water equivalent. Five stations have been equipped with snow tubes, as follows: Faust, Forked Lake, Linden, Stillwater, and Wanakena. The total snow fall in inches at each point is also published for each month. The water equivalent of this snow fall has been included in the precipitation records, under the head of "Rain or Melted Snow" and it must not be considered as extra precipitation to be added.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations for the year 1912.

MONTH.	ALTMAR.		BOONVILLE.		FAUST.		FORKED LAKE.c	
	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	4.26	a40.0	3.19	24.5	1.68	19.5	3.49	40.9
February	8.36	79.0	3.75	7.5	1.44	11.0	3.86	32.6
March	1.41	2.5	2.19	5.5	3.05	12.5	4.23	23.5
April	2.52	2.8	4.20	4.0	3.11	11.0	4.89	21.6
May	6.08	.....	6.34	.....	6.66	1.0	5.69	......
June	1.44	.....	0.83	.....	1.23	.....	0.94	......
July	2.52	.....	2.13	.....	2.96	.....	3.35	......
August	3.67	.....	3.23	.....	4.13	.....	3.44	......
September	7.54	.....	6.85	.....	6.62	.....	5.71	......
October	3.30	.....	3.40	.....	2.98	.....	5.34	......
November	4.24	.....	4.45	4.5	3.15	.....	4.60	12.9
December	5.02	b47.0	3.70	18.0	2.73	9.5	3.92	21.7
Year	50.36	171.3	44.26	64.0	39.74	64.5	49.46	153.2

a Estimated from record of melted snow.
b Estimated from records of accumulated snow.
c Published by the U. S. Weather Bureau under the name of Raquette Lake.

Recorded precipitation at the State of New York Conservation Commission rainfall observation station[a] for the year 1912.

MONTH.	HOOKER.		HORSE SHOE.		KEEPAWA.d		KNOWELHURST.	
	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	a5.40	54.0	2.76	25.5	4.17	50.4	1.87	10.5
February	a4.20	42.0	3.36	28.2	3.72	39.2	2.65	20.8
March	b1.28	9.0	1.65	15.5	3.39	21.1	3.30	11.0
April	b4.46	11.0	2.58	3.0	3.79	22.5	3.35	7.0
May	8.41	.....	6.36	.....	7.23	1.0	4.63	......
June	1.18	.....	1.47	.....	1.07	.....	0.69	......
July	2.51	.....	2.62	.....	4.29	.....	2.87	......
August	4.29	.....	2.99	.....	3.60	.....	4.38	......
September	6.91	.....	4.99	.....	5.09	.....	4.21	......
October	5.63	.....	3.08	.....	3.61	.....	4.91	......
November	3.40	c15.0	3.84	7.5	5.22	28.9	3.48	7.5
December	7.50	32.0	1.57	10.0	4.17	35.8	2.18	1.5
Year	55.17	163.0	36.77	89.7	49.35	198.9	38.52	58.3

a Estimated from snow-fall records.
b May not include water equivalent of snow fall.
c Estimated from records of accumulated snow.
d Records from this station published by the United States Weather Bureau under the name of Nehasane.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations for the year 1912.

MONTH.	LEISHER MILLS.		LINDEN.		LITTLE JOHN SETTLEMENT.		MOREHOUSE-VILLE.	
	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	7.88	63.5	.....	.....	5.04	60.5	3.27	25.0
February	6.80	62.5	.....	.....	11.15	87.5	3.22	26.5
March	4.08	13.0	.....	.....	3.37	9.8	3.18	10.5
April	4.63	9.0	.....	.....	4.78	4.3	4.92	2.5
May	7.84	2.0	.....	.....	8.12	.....	6.14	......
June	1.35	.....	.....	.....	1.22	.....	1.10	......
July	2.06	.....	.....	.....	2.95	.....	4.26	......
August	5.30	.....	a2.29	.....	3.31	.....	3.13	......
September	6.11	.....	1.91	.....	7.57	.....	7.91	......
October	4.51	.....	1.66	.....	5.03	.....	5.01	......
November	5.57	11.0	1.90	.....	4.70	0.4	5.07	10.9
December	7.27	88.0	1.54	18.1	6.37	31.1	5.62	24.5
Year	63.40	249.0	9.30	18.1	63.61	193.6	52.83	99.9

a August 13–31, inclusive.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations for the year 1912.

MONTH.	NORTH CREEK.		NORTH OSCEOLA.		NORTHVILLE.a		OLD FORGE.	
	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches*	*Inches.*	*Inches.*
January	1.91	18.5	6.64	84.0	4.23	15.9	4.55	53.9
February	3.21	23.0	6.48	70.5	3.94	12.9	4.81	28.3
March	2.46	12.0	2.19	9.5	4.44	9.6	3.90	15.4
April	3.10	6.0	4.35	10.0	4.86	11.0	5.04	13.3
May	4.17	.....	8.13	2.0	5.44	.....	6.88	......
June	0.48	.....	1.86	.....	1.19	.....	1.70	......
July	2.41	.....	4.42	.....	2.83	.....	3.33	......
August	3.33	.....	5.28	.....	3.83	.....	3.75	......
September	3.45	.....	8.27	.....	6.27	.....	5.07	......
October	4.62	.....	4.01	.....	4.60	.....	4.30	......
November	4.25	5.5	5.01	26.0	3.66	0.2	5.82	31.3
December	1.85	3.0	13.56	99.0	5.53	3.0	4.59	31.6
Year	35.24	68.0	70.20	301.0	50.82	52.6	53.24	173.8

a The United States Weather Bureau publishes records from another gage at Northville under his name.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations for the year 1912.

MONTH.	ORANGEVILLE.		OTTO MILLS.		POTSDAM.		PULASKI.b	
	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	.....	4.66	43.7	2.03	29.0	5.23	71.8
February	.....	.....	3.55	27.5	2.58	14.0	4.08	69.5
March	.....	.....	2.15	2.9	1.57	15.0	2.16	6.5
April	.....	.....	4.17	3.3	2.47	6.0	4.17	3.0
May	.....	.....	6.67	.....	7.25	.....	6.23	......
June	.....	.....	1.80	.....	1.66	.....	1.72	......
July	.....	.....	2.73	.....	1.81	.....	2.14	......
August	a3.71	.....	4.30	.....	4.88	.....	3.68	......
September	2.65	.....	7.62	.....	5.59	.....	5.73	......
October	2.12	.....	5.35	.....	2.76	.....	3.37	......
November	1.80	.....	4.43	7.0	5.74	.....	4.96	2.0
December	1.89	.....	5.29	17.5	2.16	4.2	3.42	23.0
Year	12.17	.....	52.72	101.9	40.50	68.2	46.89	175.8

a August 18–31, inclusive.
b Gage at Fox Bridge on Salmon River, about two miles upstream from Pulaski post office.

Recorded precipitation at the State of New York Conservation Commission rainfall observa on stations for the year 1912.

MONTH.	REDFIELD.		ROME.c		SMARTVILLE.		STILLWATER.	
	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches*
January	7.56	80.5	4.27	.....	6.66	69.8	4.96	36.0
February	5.06	49.0	4.49	25.5	5.32	58.0	14.56	147.0
March	3.60	13.0	3.28	14.8	2.51	9.2	4.45	4.5
April	4.29	3.0	4.84	4.5	4.62	1.0	7.06	3.0
May	7.06	.....	7.39	.....	8.41	.....	6.88	......
June	1.44	.....	1.15	.....	1.62	.....	1.72	......
July	2.62	.....	3.28	.....	a2.50	.....	2.78	......
August	5.27	.....	4.56	.....	3.54	.....	b4.50	......
September	6.73	.....	7.16	.....	7.12	.....	7.41	......
October	4.01	.....	4.27	.....	5.12	.....	4.83	......
November	4.77	3.5	4.50	4.5	6.07	10.1	4.56	14.0
December	7.18	50.0	5.91	24.2	5.63	34.5	6.33	17.2
Year	59.59	199.0	55.10	73.5	59.12	182.6	72.04	221.7

a Estimated by comparison with nearby stations.
b August 5 not included.
c At Rome city reservoir, about seven miles north of Rome.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations for the year 1912.

MONTH.	VARYSBURG.		WAKELY DAM.		WANAKENA.g		WARDS CREEK.	
	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	.....	.....	.....	.....	2.60	40.0	3.17	38.2
February	.....	.....	.....	.....	3.27	32.8	3.88	26.9
March	.....	.....	.....	.....	2.41	12.5	2.63	11.0
April	.....	.....	3.48	0.6	2.53	11.5	e3.50	......
May	.....	.....	6.50	.....	9.01	.....	8.94	......
June	.....	.....	1.35	.....	1.30	.....	2.22	......
July	.....	.....	1.90	.....	2.78	.....	3.89	......
August	a2.25	.....	4.30	.....	.....	.....	5.24	......
September	3.06	.....	3.85	.....	c0.45	.....	6.95	......
October	2.39	.....	4.40	.....	2.26	.....	2.84	......
November	3.01	.....	4.49	b10.0	d5.34	d27.9	4.90	11.2
December	2.53	.....	4.41	b13.6	d3.02	d28.0	2.09	10.0
Year	13.24	.....	34.68	24.2	f44.67	152.7	50.25	97.3

a August 15–31, inclusive.
b Record uncertain.
c September 27–30, inclusive.
d Mean of observations in two gages; one located in a forest and one located in an open space.
e Record for April 1–16, inclusive estimated. Actual record April 17–30, inclusive is 1.99 inches.
f This total includes an estimated rain-fall of 9.70 for the period when no records were taken.
g Gage read by J. Otto Hamele January-July inclusive. In new location, September-December inclusive. See notes *c*, *d* and *f*.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations for the year 1912.

MONTH.	WELLS.	
	Rain or melted snow.	Snow-fall.
	Inches.	*Inches.*
January	2.31	18.0
February	3.12	18.0
March	4.21	10.5
April	3.78	3.0
May	5.44	....
June	0.48	....
July	2.50	....
August	1.78	....
September	5.57	....
October	4.27	....
November	3.31	3.5
December	2.03	....
Year	38.80	53.0

Recorded temperatures at the State of New York Conservation Commission rainfall observation stations in the Adirondack Region for the year 1912.

MONTH.	FAUST.			FORKED LAKE.			KEEPAWA.		
	Minimum	Maximum.	Mean.	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.
January	—6.1	14.7	4.3	—4.1	17.7	6.8	—6.4	16.5	5.0
February	.4	23.2	11.8	1.1	23.9	12.5	—1.8	23.3	10.8
March	6.8	32.2	19.5	8.3	32.5	20.4	4.5	32.4	18.4
April	27.0	48.5	37.8	23.7	48.0	35.8	27.2	49.0	38.1
May	41.5	62.0	51.8	41.5	64.7	53.1	39.5	64.8	52.2
June	43.4	68.6	56.0	44.5	69.7	57.1	40.5	70.1	55.3
July	50.2	80.3	65.2	52.3	78.5	65.4	48.7	78.9	63.8
August	48.5	68.6	58.6	49.0	68.4	58.7	47.2	68.0	57.6
September	45.8	67.3	56.6	48.2	65.7	57.0	45.2	65.4	55.3
October	35.0	57.7	46.4	35.8	57.8	46.8	34.0	56.7	45.4
November	......	......	*a* 35.0	26.9	42.3	34.6	25.5	40.6	33.0
December	16.2	33.2	24.7	16.6	34.4	25.5	15.3	33.2	24.2
Yearly	......	......	39.0	......	......	39.5	......	......	38.3

a Estimated.

Recorded temperatures at the State of New York Conservation Commission rainfall observation stations in the Adirondack Region for the year 1918.

MONTH.	Morehouseville.			North Creek.			Old Forge.		
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.
January	—3.1	17.8	7.4	—0.8	20.6	9.9	—4.5	19.2	7.4
February	1.1	23.4	12.2	4.9	27.1	16.0	.4	25.6	13.0
March	9.2	34.0	21.6	11.8	36.5	24.2	7.1	34.4	20.8
April	26.2	49.1	37.6	28.9	51.1	40.0	25.1	50.1	37.6
May	39.4	64.1	51.8	43.4	66.9	55.2	41.6	64.3	53.0
June	42.7	66.9	54.8	46.4	73.3	59.8	41.6	69.5	55.6
July	50.1	78.1	64.1	55.2	80.0	67.6	50.2	78.7	64.4
August	47.8	67.2	57.5	52.2	71.0	66.6	47.9	69.0	58.4
September	44.4	64.0	54.2	48.2	67.0	57.6	45.9	65.8	55.8
October	34.6	57.0	45.8	37.9	61.2	49.6	35.0	57.4	46.2
November	26.2	42.3	34.2	27.6	45.9	36.8	26.3	42.5	34.4
December	14.5	34.3	24.4	20.0	39.4	29.7	16.9	35.5	26.2
Yearly	......	......	38.8	......	......	42.8	......	......	39.4

Recorded temperatures at the State of New York Conservation Commission rainfall observation station in the Adirondack Region for the year 1918.

MONTH.	Potsdam.			Rome.			Stillwater.		
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.
January	—1.4	16.9	7.8	3.2	20.8	12.0	—2.4	18.9	8.2
February	4.5	24.8	14.6	8.6	25.4	17.0	4.0	25.4	*g*14.7
March	10.4	32.2	21.3	14.2	32.1	23.2	10.6	36.0	23.3
April	30.2	52.2	*a*41.2	31.1	52.1	41.6	28.2	51.0	39.6
May	46.1	67.4	56.8	44.3	66.0	*b*55.2	44.9	64.4	54.6
June	49.5	73.2	61.4	46.2	72.1	59.2	43.2	70.2	56.7
July	58.0	83.5	70.8	56.7	83.2	*c*70.0	52.0	79.7	65.8
August	52.3	74.0	63.2	53.1	72.3	62.7	49.9	71.7	*d*60.8
September	49.2	68.2	58.7	50.8	69.0	*e*59.9	48.9	67.9	58.4
October	41.3	62.3	51.8	38.6	62.7	50.6	37.3	59.5	48.4
November	......	......	*f* 37.0	31.0	47.2	39.1	30.9	45.2	38.0
December	17.7	36.2	27.0	22.5	38.9	30.7	19.5	36.9	28.2
Yearly	......	......	42.6	......	......	43.4	......	......	41.4

a 29 days.
b 27th and 28th missing.
c 1st, 16th and 24th missing.
d 25th missing.
e 15th missing.
f Estimated.
g 22nd and 26th to 29th, inclusive, missing.

Recorded temperatures at the State of New York Conservation Commission rainfall observation stations in the Adirondack Region for the year 1912.

MONTH.	Wanakena.a			Wells.		
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.
January	—3.7	16.3	6.3	—2.5	21.1	9.3
February	0.6	22.2	11.4	3.0	28.0	15.5
March	7.0	32.6	19.8	9.4	37.7	23.6
April	27.2	50.1	38.6	29.0	52.0	40.5
May	40.4	64.0	52.2	42.1	67.5	54.8
June	45.4	70.1	57.8	43.6	75.2	59.4
July	51.3	79.1	65.2	51.2	83.9	67.6
August		No record.		48.9	73.7	61.3
September		No record.		47.8	68.5	58.2
October	35.4	58.7	47.0	35.1	60.9	48.0
November	28.1	45.7	36.9	26.6	46.8	36.7
December	15.2	38.8	27.0	18.9	37.8	28.4
Yearly	....	....	....	....	....	41.9

a Records, January to July inclusive, by J. Otto Hamele, for remainder of year by New York State School of Forestry at a new location.

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STATE OF NEW YORK

CONSERVATION COMMISSION

PUBLICATIONS RELATING TO THE WORK OF

THE DIVISION OF INLAND WATERS

REPORTS

First Annual Report Published January 1, 1912

Includes Commission's annual report and decisions on applications for approval of plans for public water supplies, for sewerage systems, and for the construction of dams; Commission's report on River Improvements for the benefit of public health and safety; Commission's progress report on Water Power and Water Storage Investigations with details of such investigations on the Hudson and Oswegatchie River watersheds; Commission's report on Inspection of Dams; Commission's progress report on hydrographic work in co-operation with United States Geological Survey; and excerpts of Conservation Law relating to the Division of Inland Waters.

Second Annual Report Published September, 1912

Includes Commission's annual report to the Legislature of 1913 for the Divisions of Lands and Forests, Fish and Game, and Inland Waters, and Commission's report in detail for the Division of Inland Waters, including reports on Conservation of Water for Power Purposes and Hydraulic Development, River Improvement, Drainage, Water Supply and Sewerage, and Inspection and Supervision of Hydraulic Structures.

MISCELLANEOUS

Pamphlet — "State of New York, Conservation Commission, Circular of Information." Published September, 1911

Issued for distribution at State Fair at Syracuse, 1911.

Pamphlet — "First Annual Report of the Conservation Commission." Published January, 1912

Issued for transmittal to the Legislature, January 10, 1912, and includes a brief report of the work of the Division of Inland Waters.

Pamphlet — "Fishways for Dams." Published January, 1912

By Alex. Rice McKim, Inspector of Docks and Dams of the Conservation Commission.

Pamphlet — "Watershed of the Genesee River." Published February, 1912

Issued for transmittal to the Legislature, February 15, 1912. (Reprinted in the First Annual Report of the Division of Inland Waters.)

Pamphlet — "State Development of Water Power." Published February, 1912

The statement of Hon. Geo. E. Van Kennen, Chairman of the Conservation Commission of the State of New York before the Joint Judiciary Committee of the Senate and Assembly, on the Water Storage Bills.

Edition exhausted

Pamphlet — "State Development of Water Power." Published March, 1912

The statement of Clark H. Hammond, Corporation Counsel of the City of Buffalo, before the Joint Judiciary Committee of the Senate and Assembly of 1912, on the Water Storage Bills. **Edition exhausted**

Pamphlet — "Rules and Regulations governing Municipal Water Supply Applications." Published April, 1912
Issued for distribution to prospective applicants and others interested. (Supersedes the rules published by the former State Water Supply Commission.)

Pamphlet — "Rules and Regulations governing Sewerage Applications." Published April, 1912
Issued for distribution to prospective applicants and others interested.

Pamphlet — "State Development of Electrical Energy." Published June, 1912
An address by Hon. Geo. E. Van Kennen, Chairman of Conservation Commission, State of New York, at the Third Annual Conference of Mayors at Utica, June 10, 1912. Edition exhausted

Pamphlet — "Cheap Electricity for All." Published September, 1912
Catechism treating facts regarding State development of electric energy.

Pamphlet — "The Conservation Law of the State of New York." Published August, 1912
Chapter 647 of the Laws of 1911 (Chapter 65 of the Consolidated Laws), as amended during the legislative session of 1912.

Pamphlet — "Second Annual Report of the Conservation Commission." Published January, 1913
Issued for transmittal to the Legislature, January 15, 1913, and includes a brief report of the work of the Division of Inland Waters. (Reprinted in the Second Annual Report of the Division of Inland Waters.)

Pamphlet — "High and Low Water in Lake George." Published April, 1913
Report of the Conservation Commission on the subject. Issued for transmittal to the Legislature, April 14, 1913.

Pamphlet — "State Hydro-Electric Development." Published April, 1913
Letter from George E. Van Kennen, Chairman of the Conservation Commission, to A. E. Smith, Speaker of the Assembly, explaining why the Murtaugh-Patrie bill should become a law. Edition exhausted

Pamphlet — "Pure Water; Plenty of it in Every Home and Factory." Published January, 1913
Nature's own solution of the water problem in Genesee, Orleans, Niagara and a part of Monroe county. Contains description of the proposed Linden Reservoir and the proposed Orleans Water Supply District, with maps, sections and profiles.

PAMPHLET PUBLICATIONS OF THE FORMER STATE WATER SUPPLY COMMISSION WHICH ARE AT PRESENT AVAILABLE.

Pamphlet — "New York's Water Supply and Its Conservation, Distribution and Uses." Published September, 1910
Issued for distribution at State Fair at Syracuse, 1910.

Pamphlet — "Water Resources of the State of New York." Published September, 1910
By Henry H. Persons, President of the State Water Supply Commission. Issued for distribution at National Conservation Congress at St. Paul, Minn., 1910.

Pamphlet — "Water Power for the Farm and Country Home." Published January, 1911
By David R. Cooper, Engineer-Secretary to State Water Supply Commission. (Reprinted in the Sixth Annual Report of the State Water Supply Commission.)

Pamphlet — "Final Order for the Regulation of the Flow of the Hudson River. Published May, 1911
Issued for transmittal to the Legislature, May 22, 1911.

INDEX TO ASSEMBLY DOCUMENTS, 1913